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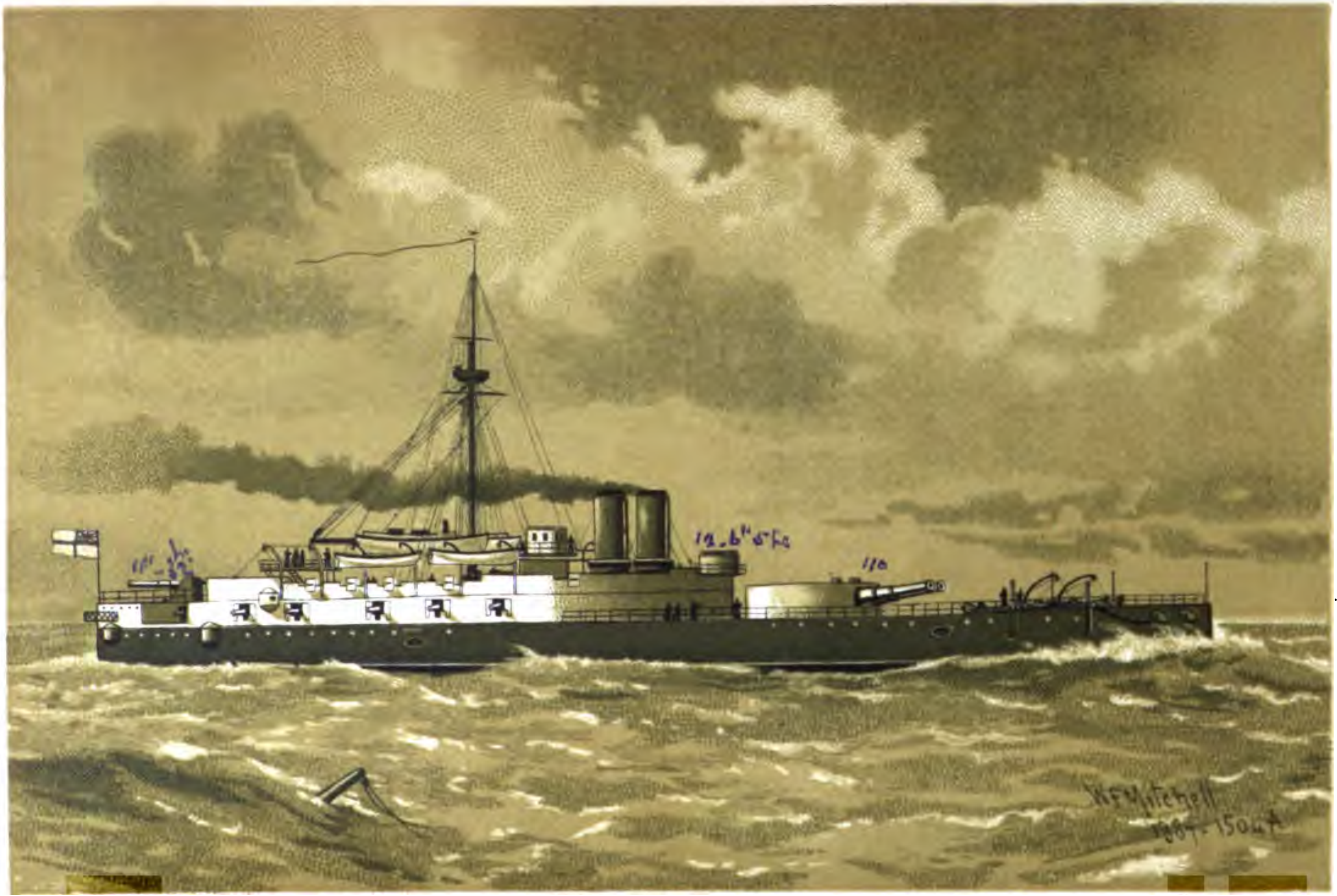

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H.M.S. "VICTORIA".

THE

NAVAL ANNUAL,

1887.

SECTION I.—by Lord Brassey, K.C.B.

SECTION II.—by F. K. Barnes, Esq.

SECTION III.—*Gunnery*—by Captain Orde Browne, late R.A.

SECTION IV.—*Torpedoes*—by Lieutenant Sleeman, late R.N.

The Appendix.—Consists entirely of Public Documents.

> "This England never did, nor never shall
> Lie at the proud foot of a conqueror.
> * * * *
> Come the three corners of the world in arms
> And we shall shock them! Nought shall make us rue
> If England to itself do rest but true."

1888.
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PREFACE.

THE present number of *The Naval Annual* has been prepared in circumstances of grief, which will be understood by naval readers. It was commenced in the sad solitudes of the Indian Ocean; it was concluded under the lee of Ascension.

ERRATA.

Page 9, line 5, *for* "than the" *read* "than in the."
" 18 " 3, *for* "a flying squadron" *read* "flying squadrons."

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sources inaccessible to the public. *The Naval Annual* is a compilation from Parliamentary Papers, from *The Times* and *Standard*, *Engineer*, *Engineering*, *Iron*, *The Broad Arrow*, *The Army and Navy Gazette*, *The United Service Gazette*, *The Nautical Magazine*, and the *Journal of the United Service Institution*. Among foreign sources of information obligations to that admirable paper *Le Yacht* are repeatedly acknowledged. The *Mittheilungen aus Gebiete des Seewesens*, the *Rivista Maritima*, and the *Revue Maritime* have been carefully perused. The tables of ships are founded on those published in the Marine Almanack, issued by Messrs. Gerold of Pola. It will be seen that the periodical literature on the Navy is sufficiently

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The compiler has been sustained in his task by a sense of duty to the Navy and to the country, which he feels in an equal degree whether in or out of office. He has had opportunities such as are rarely given to a civilian, of seeing the work of the Navy. He offers his conclusions for what they may be worth to the consideration of the service and the public.

In the last Session of Parliament questions were asked in the House of Commons with reference to contributions to *The Naval Annual* from officials of the Admiralty. Grateful acknowledgments are due to Mr. Lambert, an able public servant, who, on the departure of the compiler on a long foreign voyage, kindly undertook to see *The Naval Annual* through the Press, but neither for the first issue nor for the present number has information been supplied from official sources inaccessible to the public. *The Naval Annual* is a compilation from Parliamentary Papers, from *The Times* and *Standard*, *Engineer*, *Engineering*, *Iron*, *The Broad Arrow*, *The Army and Navy Gazette*, *The United Service Gazette*, *The Nautical Magazine*, and the *Journal of the United Service Institution.* Among foreign sources of information obligations to that admirable paper *Le Yacht* are repeatedly acknowledged. The *Mittheilungen aus Gebiete des Seewesens*, the *Rivista Maritima*, and the *Revue Maritime* have been carefully perused. The tables of ships are founded on those published in the Marine Almanack, issued by Messrs. Gerold of Pola. It will be seen that the periodical literature on the Navy is sufficiently copious. To an enthusiast in the naval cause it has not been an ungrateful task to compile a connected narrative of the naval administration of the year from these materials.

"Conquisita diu, dulcique reperta labore."

It has been the aim not only to record the past, but to draw lessons for the future, and to offer something more than a barren criticism. To use the words of a French naval author, "A notre sens rien n'est plus vain que la critique quand elle est stérile." For those on whose shoulders rests the heavy responsibility of administering the Navy, it cannot but be a help to have the opinions and suggestions of outsiders. It was a wise observation of Pericles, "The great impediment to action is in our opinion not discussion, but the want of that knowledge which is gained by discussion preparatory to action."

It will be acknowledged by readers of *The Naval Annual* that no trace of political partisanship can be discovered in its pages. The compiler has never engaged in naval discussions with the narrow and paltry purpose of damaging opponents rather than serving the Navy. Of the present Board of Admiralty he has nothing to say which is not praise.

Ascension, *November 8th*, 1887.

Note.—In Section I. the compiler is indebted to Sir Nathaniel Barnaby and Mr. Barnes for the chapters on the Progress of Steam Navigation, the Mercantile Marine, and the Mosquito Fleet. The authorship of the other sections is acknowledged on the title-page.

In the present volume the Appendix has been extended to 252 pages by the inclusion of a large amount of reprint from British official publications. In subsequent numbers it is proposed to give condensed abstracts only of public documents accessible to all interested in naval matters. The interval since the return of the compiler to England has not been sufficient to enable him to deal satisfactorily with the voluminous blue-books published in 1887.

Before going to press it was decided to omit all details relating to the Brennan torpedo.

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* By permission of Admiral Sir George Elliot, K.C.B.

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RECENT NAVAL ADMINISTRATION.

CHAPTER I.

British Navy Estimates for the Year 1887–8.

Lord George Hamilton's memorandum.

In introducing some observations of a general character with reference to the estimates of 1887–8, the grateful acknowledgments of naval critics and reformers should be tendered to Lord George Hamilton for the explanatory memorandum for the first time presented to Parliament in the past session. The memorandum of the first lord should, however, be supplemented, as Sir Spencer Robinson has so often urged, by a report from the first sea lord, similar to the review of the state of the Navy and its requirements which is annually published together with the report of the Secretary of the United States Navy.

Reduction in Navy Estimates, 1887–8.

Following the order observed by Lord George Hamilton, the reduction in the estimates is the first point for consideration. The present Board of Admiralty claim to have secured a material increase in the strength of the Navy *pari passu* with a decrease in the expenditure. It is satisfactory to know that the Navy will receive, in the current financial year, a large and valuable reinforcement of ships, but the credit attaching to the Naval Administration for the addition must be shared with previous Boards of Admiralty. The recent powerful reinforcement of the fleet is a fortunate inheritance for which the Board, now sitting at Whitehall, are indebted to Lord Northbrook's administration, as the exponents of the national demand that the Navy should be made stronger. In making this remark, it is not intended to convey or to suggest that under the present able administration no progress will be made in the direction of judicious economy. There is ample scope for their useful labours. In fairness, however, it must be admitted that it would not have been possible to effect a reduction so considerable as that exhibited in the present estimates by economy alone. Reforms of that general character, which are indicated and described in the memorandum of Lord George Hamilton, must of necessity be gradual. The estimates for 1887–88 show a total reduction of £793,000. Improved administration counts for something, but the chief reductions are outside the sphere of dockyard administration, and represent a diminished purchase of ships and equipments. The stores vote is reduced by £44,000, and the vote for machinery and ships built under contract by £565,300.

For the year 1887–8 the Navy Estimates provide for the following expenditure for ships building or completing:—

	£
Armoured ships	2,072,059
Protected "	393,702
Unprotected "	521,380
Torpedo boats	33,114
Steam launches	24,000
Superintending contract work	14,000
Grand total expenditure on all ships building and completing	£3,058,255
Refitting and repairing ships	£670,931
Total expenditure under Votes 6 and 10	£5,021,417
Total number of men employed in dockyards at home	19,554

Naval Ordnance:	£
Gun mountings, torpedoes, torpedo carriages, &c., provided under Vote 10 above	593,700
Expenditure for Naval Ordnance provided in Army Estimates	1,707,561
Total expenditure for Naval Ordnance	£2,301,261

An important and long-contemplated change in the distribution of charges as between Army and Navy Estimates was announced by Mr. Stanhope in the last session of Parliament. The whole charge for naval armaments will in future be borne on Navy Estimates, while the charge for conveyance of troops will be transferred to Army Estimates.

Appropriation of expenditure.

Turning to the appropriation of expenditure, it is satisfactory to observe that while a total appropriation of £3,058,255, is devoted to construction, the amount for fitting and repairs will not exceed

£670,931. It is evident that a tight hand will be held upon proposals of an extravagant nature for alterations and refits of ships not worth reconstruction. Resolute as the present Board evidently are to keep down unprofitable expenditure, the appendices to the Estimates show that they have not been able to surmount all the difficulties with which their predecessors had to contend. Taking the repair of ships of the "C" class, there is no sensible reduction in the cost of repairing these vessels, while the difference in the cost of a refit, as between the home and the foreign yards, is not less conspicuous than before. These remarks are illustrated by the following enumeration:—

Repairs abroad and at home.

ESTIMATES FOR REPAIRS.

	Length of Time in Commission.	Amount.
Home Yards.		£
Cleopatra . . .	6 years 6 months	40,603
Curaçoa . . .	6 „ 4 „	40,871
Champion . . .	6 „ 2 „	40,900
Garnet . . .	7 „ 10 „	33,718
Refit Abroad.		
Carysfort . . .	6 „ 5 „	7,010

The valuation of the Fleet forms an interesting feature in the first lord's statement. It will not supply a standard or scale for the amount of reconstruction to be undertaken for the Navy. Upon the grave question of the sufficiency of Navy estimates, the answer must always depend on the efforts which are being made elsewhere. If foreign powers cease to build ironclads, we may hold our hands. If they push the building of their torpedo flotillas, we must be prepared to meet them. If they multiply cruisers to attack our commerce, we must be provided adequately for its defence.

Valuation of the fleet.

It may be assumed that the British Admiralty should at all times be prepared to meet any combination which the evolution of political events might possibly bring about. In certain contingencies, a combination is conceivable between Russia and France. Our desire is to maintain cordial relations with all foreign powers, and not less with those named than with others. But it is the part of prudent statesmanship to stand prepared for emergencies.

Naval expenditure in France and Russia.

The French estimates for 1888 provide a total appropriation for new construction amounting to £1,849,136. The list of the more important ships in construction is as follows:—

Ironclads (8)	Neptune, Formidable, Hoche, Magenta, Amiral-Baudin, Brennus, Requin, Marçeau.
Armoured gunboats (4) .	Cocyte, Phlégéton, Styx, Grenade.
Armoured cruiser (1) . .	Dupuy-de-Lôme.
Cruisers à batterie (2) . .	Tage, Cecille.
First-class cruisers (3) . .	Jean Bart, Alger, Isly.
Second-class cruisers (2) .	Davoust, Suchet.
Third-class cruisers (6) .	Surcouf, Forbin, Tronde, Lalande, Cosmao, Coëtlogon.

It will be observed that the programme for 1888 includes two new ironclads, the new Brennus and the Dupuy-de-Lôme.

Russia. While in France the growth in expenditure on the Navy has been arrested, in Russia a new development of activity is taking place, to which the British Admiralty cannot be indifferent. A programme of construction has been approved by the Czar, providing four distinct fleets for the Baltic, the Black Sea, the White Sea, and the Pacific. The two fleets last named, which consist exclusively of gun-vessels and torpedo boats, may be dismissed from further consideration.

The strength of the new Baltic fleet is fixed at—

11 ironclads of the 1st class, 10,000 tons.
4 ironclads of the 2nd class, 7000 tons.
11 gunboats.
10 cruisers, 3700 tons.
6 transports, 2000 tons.

These ships will be additional to numerous vessels of older date, for the most part in good condition.

The Black Sea fleet will consist of—

8 ironclads of the 1st class, 10,000 tons.
6 sloops.
10 torpedo vessels.

The annual expenditure on new construction is fixed at £1,720,000, of which £800,000 are to be charged against the Ordinary Budget.

The construction of ships in accordance with the approved programme was commenced in 1883. The new ironclads now in progress for the Baltic fleet are the Alexander Newski, of 5796 tons, the Admiral Nachimoff, 7780 tons, the Alexander II., and the

Nicholas I., each of 8444 tons, and the Pamjatz Azowa, or Remembrance of Azoff, 6000 tons. The Vladimir-Monomach, and the Dmitrij Donskoi have been recently completed. Their speed on the trials was 15½ to 16 knots. The Alexander II. and the Nicholas I. are being built by the Société de Construction Franco Russe, at their yard near St. Petersburg. The Vladimir-Monomach, the Admiral Nachimoff, and the Remembrance of Azoff have been entrusted to the Baltic works, an establishment on the Neva. Three ironclads of the first class, described in the section devoted to shipbuilding, are now building in the Black Sea.

Having before us the expenditure for construction as at present approved by the Governments of France and Russia, we have a measure or standard by which we can determine the sufficiency of our own estimates. It may be doubted whether further reductions can be safely made until some relaxation is observable in efforts elsewhere. From Army estimates we must provide for the defence of coaling stations abroad and harbours at home. Our deficiencies were enumerated in the *Fortnightly Review* in June 1887. "Our colonial garrisons are singularly small." "Our commercial ports are virtually undefended." "Plymouth and Portsmouth unfinished." "The completion of the defence by fortification of our coaling stations." Our coaling stations should be a source of strength, not weakness, to the Navy, and "fortification is the most economical way of securing positions from attack." Guns are wanted everywhere. If we turn to the Navy Estimates, we were informed by Lord George Hamilton, in his Mansion House speech, that the recent manœuvres have shown that the substitution of steam propulsion for sailing power has exposed the ports and commerce of this country to risks which were unknown under the old conditions. In the present circumstances it may be accepted that our estimates are fairly equal to the requirements of the country. Reductions must depend on the course pursued by other administrations than that which presides at Whitehall.

Our position in the Mediterranean.

In connection with the Navy Estimates a decision should be taken with reference to the important question of our future position in the Mediterranean. In certain quarters the diversion of trade to the Cape route or the Canadian Pacific is accepted too readily as an inevitable consequence of the outbreak of war.

The completion of the Canadian Pacific line is doubtless an advantage as affording an alternative route to Australia for mails and passengers. It has the disadvantage for goods of increased cost. Most assuredly the opening of the new route to the colonies should not make us indifferent to the security of our established means of communication by the Suez Canal.

If we propose without a struggle to abandon the shortest and most convenient communication to India and Australia, the sooner we relieve ourselves of Egypt, Malta, and Gibraltar, the better. These positions are indeed useless unless we are resolved to take full advantage of the support they would afford to our naval power.

It can hardly be supposed that when all the consequences of our retreat from the Mediterranean are fully appreciated, such a course would be approved by the country. The loss of trade and prestige would be a fatal blow to our noble empire. It is a blow which we are well able to avert if we make those efforts which are prompted alike by prudence and by patriotism. The route through the Mediterranean might be secured against any combination of force to which it is conceivable that we could find ourselves opposed. In a general European war—which may heaven avert!—we should not fight alone. Italy is a cordial ally, and her Navy has become a power of the first order. We hold the strongest fortresses in the waters of the Mediterranean, and our trade would receive protection from powerful convoys. The operations carried out by the fleet of Admiral Lafont, in the French naval manœuvres of the summer, might be put in practice in war by a British fleet.

When the easy classes in England announce to the world that they care more to spare themselves an extra halfpenny of income tax than to maintain their imperial connection with India and Australia, it will be a fatal sign that the star of England's glory is declining to the West. We must then look to the great Republic to uphold the just and generous influence of our race in the family of nations.

> "Hands all round
> We sail'd wherever ship could sail,
> We founded many a mighty state;
> Pray God our greatness may not fail
> From craven fears of being great."

CHAPTER II.

ECONOMIES AND REFORMS IN NAVAL ADMINISTRATION.

Lord Randolph Churchill and House of Commons Navy Estimates.

THE active interest displayed by Lord Randolph Churchill in the administration of the Navy is a novel incident in the history of the year. It is unnecessary to examine those criticisms in relation to the design of certain ships, to which Lord Randolph Churchill made no reference in his more deliberate statement in the debates on the Navy Estimates on the 18th July. In the speech, delivered in the House of Commons, the excessive cost of dockyard-built ships was the first point brought forward. The most recent figures are supplied in the table below, giving ships included in the shipbuilding programme for 1887–8.

Increased cost of ships.

Navy Estimates, 1887-8.

ESTIMATED COST OF SHIPS IN THE PROGRAMME.

	Formerly estimated.	Now estimated.
	£	£
Camperdown	668,947	680,951
Howe	633,324	667,648
Rodney	635,081	664,359
Collingwood	588,575	629,594
Edinburgh	564,817	642,451
Aurora	284,086	284,385
Mersey	170,901	220,152
Severn	172,491	215,258
Thames	178,032	208,956
Forth	172,278	202,889
Amphion	171,402	193,546
55 1st-Class torpedo boats	808,816	822,941

In the completing stage an excess over the estimated cost is too generally found, and when there has been delay in completing, as in the case of the Edinburgh, the excess will certainly be increased. In the programme of 1887–8 the excess over the original estimates in the Mersey class is unsatisfactory. The ships were altered too much in the dockyards.

In the admitted fact of a large increase in the cost of building, in the interval subsequent to 1870, we have no direct evidence of defective administration. The construction of ships, even the so-called unarmoured ships, has undergone a revolution. The introduction of the torpedo has compelled the naval architect to meet that deadly weapon by coffer-dams, internal bulkheads and other devices, all tending to increase of cost. The composite system of building, now generally adopted for unarmoured vessels, is infinitely more costly than the construction in wood of the older day; or in steel and iron as now exclusively used in the Mercantile Marine. The composite method is preferred in the Navy with the view of enabling ships to keep the sea for lengthened periods, without the necessity of docking to remove the marine growth so detrimental to speed. The revolution in gunnery, and more especially the introduction of the numerous quick-firing guns into the armaments of ships, has involved the necessity of providing numerous protected positions. The construction of launching-tubes for torpedoes involves much costly and complicated work. To secure the higher speeds now most properly insisted upon, a large addition to engine power is required. This incomplete enumeration of the new requirements goes far to explain the advance in expenditure to which Lord Randolph Churchill directed his criticisms.

Comparative cost in dockyards and under contract.

The comparison of dockyard-built and contract-built ships tells more seriously against the Admiralty than the comparisons of ships of different types built at different periods. The differences, however, are in many cases inconsiderable. The estimates for 1887–8 give the cost of hulls, machinery, and fittings for the seven sister ships of the belted cruiser type, and it will be observed that the Palmer Company, with the advantage of building two ships side by side, are only £3000 below Chatham, which is building only one ship of the type.

		£
Aurora	**Pembroke**	284,385
Immortalité	**Chatham**	278,720
Australia	**Napier**	266,413
Galatea	„	266,100
Narcissus	**Earle**	266,551
Orlando	**Palmer**	275,705
Undaunted	„	275,325

In endeavouring to measure fairly the cost of building in the dockyards, many considerations must be borne in mind. Contractors for the Admiralty may sustain losses by their contracts. The dockyard expenditure is swollen by the unavoidable expenses of the maintenance of establishments on too extensive a scale to be profitably employed in times of peace. Workshops and floating docks are more spacious and farther apart than is necessary. In scattered and rambling establishments work is inevitably more costly than the more compact premises of the contractors.

General charges.

The dockyards, again, are weighted with a staff of officers to superintend, and with a body of workmen in the department of the Master Attendant, performing essential duties in keeping in order moorings and buoys, docking, undocking, and transporting ships, and other similar services vaguely classed as indirect charges, and which cannot fairly be connected with shipbuilding. To separate the charges which properly belong to shipbuilding from those which strictly pertain to the general service of the Navy should not be an impossible task. It would be a simple act of justice to many deserving professional officers who are struggling under difficult conditions to make dockyard work a success. A careful tabulation of charge on equitable principles would tend to remove from the public mind a good deal of the prejudice against public administration which now exists.

Dockyard schools.

Lord Randolph Churchill referred to various items which go to swell the general charges. He was not the first critic of the expenditure on churches and schools in the dockyards, but in his speech on the Navy Estimates he was the first to criticise publicly. It was admitted by Lord George Hamilton that the case for enquiry was strong. Sir Edward Reed was of opinion that the dockyard schools are an anachronism in these days of advanced public education in the board schools. The dockyard schools should be closed under an arrangement with the Education Department, who should take over the teachers, and carry on the work outside the dockyards.

Dockyard chaplains.

For the chaplains of the dockyards it may be pleaded that their duties could not be undertaken by the local clergy without a substantial payment from the Admiralty, and that some appointments on shore are necessary to attract men of good qualifications to the clerical service of the Navy, in the trying conditions which obtain afloat.

Rewards and promotions for special exertions and services.

In dealing with dockyard management it must be accepted as a leading principle that it is practically impossible to obtain from officers engaged in administrative duties that keen and ceaseless vigilance on which economy depends, unless the Government is prepared adequately to reward men of conspicuous merit. If the Treasury is not prepared to allow special promotion, or to make pecuniary grants for unusual exertions, it cannot be expected that such efforts will be made. It is deadening and altogether fatal to treat all alike irrespective of merit. Economy in the dockyards depends on the officers of the yards. They alone have minute local knowledge and personal acquaintance with the workmen, and if it is desired to bring their knowledge and experience to bear on the irksome task of keeping down expenditure, a motive-power must be supplied from the natúral and universal source of enlightened self-interest.

The principles of administration which have been recommended for the dockyards are equally applicable, whatever be the nature of the employment. Writing with reference to agriculture, Turgot said truly:—"Il est inutile de prouver que chaque particulier est le seul juge compétent de cet emploi le plus avantageux de sa terre et de ses bras. Il a seul les connaissances locales sans lesquelles l'homme le plus éclairé n'en raisonne qu'à l'aveugle. Il a seul une expérience d'autant plus sûre qu'elle est bornée à un seul objet. Il s'instruit par des essais réitérés, par ses succès, par ses pertes, et acquiert un tact dont la finesse, aiguisée par le sentiment du besoin, passe de bien loin toute la théorie du spéculateur indifférent."

Payment by time and by results.

Probably no feature in dockyard administration has been so fatal to economy as adherence to the plan of payment for labour by time rather than by results. The deadening effect of the system was pointed out by an early master in the art of naval administration. In a letter to the Intendant at Rochefort, Colbert gave order as follows:—

"Je ne crois pas qu'on puisse être bien servi et à bon marché tant qu'on fait faire ces ouvrages à la journée, tant à cause de la difficulté de la surveillance que parce qu'il nait de cette manière de faire une obscurité qu'il importe d'éviter. Aussi je vous prie de faire des dévis et des marchés à prix faits pour tous les ouvrages."

My father, guided by no small experience in this matter, arrived at the conclusion that day work in railway building was more costly than piece work by at least thirty per cent. It is probable that the difference in the cost of labour in the dockyards, where payment is made by time, and the cost of labour in the contractors' yards, where earnings depend on results, may be taken roughly at the figure established by experience in the case of railways. If this be a fairly accurate comparison, and if the cost of labour in the building of ships be taken roughly at forty per cent. of their total cost, we arrive at the result that a dockyard-built ship will be ten to fifteen per cent. dearer than a ship built under contract. The cost might be reduced by having recourse more extensively to piece work, or by substituting a judicious classification of workmen for the present uniform rate of pay, independent of individual skill and energy. It would not be economy to take away work from the yards, and leave unused their great resources in skill, labour, and machinery, resources which must be preserved unimpaired to meet the emergency of war.

Classification of workmen.

The hesitation to sanction a classification of workmen can only be explained by a want of confidence in the impartiality of foremen and inspectors. There may be force in the admissions of Lord George Hamilton that powerful family influences are felt in a body of workpeople, among whom more consanguinity is to be found than exists in any similar number of workpeople in the world. We look to the Director of dockyards and the professional advisers of the naval superintendents to meet this difficulty, and to introduce a better and more stimulating system of rewarding labour.

More direct authority over workmen should be given to professional officers.

It has been shown again and again that the authority which should be exercised over the workmen in the dockyards is weakened to the serious disadvantage of the public service by requiring an appeal to the superintendent before any effective penalty can be inflicted, or dismissal enforced upon idle and incompetent workmen. In such cases professional officers of the yards should have plenary powers. The objection that these officers are wanting in backbone and cannot be trusted must not be entertained. If the service does not furnish the men we want, we must recruit them at any cost from the outside. To raise the professional officers to the position of authority, which is their due, and without which they cannot serve the country with full efficiency, is not to injure in any sense the position of the Naval superintendent.

General view as to remedy for defective management in dockyards.

Looking on this interminable problem of the management of the dockyards, as the son of an old contractor, and by the light derived from observation of his methods of administration, it is my duty to repeat a conviction that it is not by centralisation at the Admiralty, not by changes of organisation looming large on paper, but of small consequence in the practical management of the yards, that the best results in administration will be attained. The true method is to give to the technical officers the stimulus of advancement and liberal reward for success, and to punish repeated failure by dismissal. The same principle applies to the cases of the workmen. Thus stated, the remedy seems at once so obvious, and so easy of application, that it is hard to understand why it has not been applied long ago to the dockyards. It must be admitted that there are difficulties in the way. The conditions of private and public business are not the same. The greatest obstacles arise out of the claim of Parliament to control, and the necessity for entrusting the exercise of that control to officials whose tenure of office is too short to enable them to gain a thorough knowledge of the business they conduct, or the numerous agents on whom they depend. Hence that spasmodic action which, as Mr. Goschen said at Liverpool, is the curse of our administrative system.

When dockyard management is called in question, the removal of the naval superintendents is sometimes urged as a sovereign remedy. While it is desirable that the authority of the professional officers should be strengthened, the supervision at present exercised by the naval superintendents of the yards is essential to efficiency.

Naval superintendents and professional officers.

'Les Arsenaux de la Marine,' by M. Gougeard.

The true relation between the naval superintendents and the professional officers of the yards was clearly stated by Captain Gougeard in his excellent treatise, 'Les Arsenaux de la Marine':

"Il est absolument inexact de penser et de dire que l'instrument de guerre, bâtiment de combat, artillerie, doive être produit par ceux qui s'en servent, et que, sous ce prétexte, les officiers de marine sont en droit de réclamer la construction des vaisseaux, les artilleurs celle des canons, l'infanterie celle des fusils, etc. La vérité est infiniment plus facile à formuler; l'instrument de guerre doit être produit tout simplement par celui qui a appris à le construire, et dont la mode d'éducation et d'instruction aura été dirigé spécialement vers ce but."

"Aux marins appartient, sans conteste, le droit d'indiquer, de formuler des qualités que doivent réunir les armes de guerre, navires, canons, fusils, etc.; et aussi les conditions de rayon d'action de facilité d'évolution, de vitesse, de résistance à la perforation, en ce qui concerne les navires; de poids, de résistance, d'efficacité en ce qui concerne les armes; à eux de déterminer et de fixer les conditions auxquelles le matériel, sous toutes ses formes, doit satisfaire."

We have the weighty opinion of Sir Charles Palmer in favour of the separation of the constructing or professional from the naval department. In so far as the actual supervision of construction and of the labour employed upon it is concerned, Sir Charles Palmer undoubtedly gives expression to a sound and practical view. The naval superintendent will, however, remain the supreme controlling authority under whom the several departments of work are centralised. He is the local representative of the Board of Admiralty. His naval experience, advice, and authority are needed at every turn both in directing the fitting of ships for the sea service, and in keeping a necessary check on the demands from ships in commission, which a merely civil officer would not be in a position to resist.

Constructors.

In order to secure for the able professional officers of the dockyards that authority which it is essential for the good of the service that they should command, it was determined under Lord Northbrook's administration to adopt a scheme originally produced by the joint labours of Sir Houston Stewart and Mr. White. The new organisation would have been received with universal approval but for the restriction imposed on the admission of certain foremen of the yard into the new corps. It was thought necessary to insist on high scholastic qualifications. On the first constitution of the corps greater liberality might have been shown. The practical test might have been accepted of efficiency at the dock side in superintending the construction of vast and highly complicated structures.

Relative rank.

For the due recognition of the professional officers a suitable relative rank with the Navy should be granted. In France the head of the Corps of Constructors ranks with a Rear-Admiral. A Director of Naval Construction ranks above a Captain, and after a Rear-Admiral. Engineers answering to our Constructors of the first-class rank with captains; Engineers of the second class with commanders.

Professional officers should be educated in Britannia.

To complete the arrangements for the reorganisation of the constructive staff, it would be well to afford facilities for youths intended for the professional line in the service to receive their early education in the Britannia. From the Britannia they would proceed to their dockyard course.

Admiralty Office.

We have in pursuance of a recent decision been spared an expense with which we were threatened, in the demolition and reconstruction of the Admiralty Office. The present building is not unsuitable for the work, nor is it unsightly. A new roof would greatly improve the top floor, where the Admiralty library is placed in a space closely resembling the double bottom of an ironclad, and in places less than four feet in height. The scattered offices are not so inconvenient as might be supposed. If communication from house to house may sometimes involve the loss of a few moments, it is refreshing at intervals to breathe the fresh air even in New Street.

Guard ships of the steam reserve.

In this connection it may be convenient to refer to other economies. Allusion has been made elsewhere to the waste of money on the maintenance of useless hulks. The loss to the service from this cause is seen in a conspicuous degree, when, as in the case of the Asia at Portsmouth, the guardship of the steam reserve is allowed to remain at moorings in the harbour. At Chatham and Devonport the waste of time and labour, in keeping up communication between the dockyard and an establishment afloat, has been obviated by bringing the ships alongside.

It may safely be said that nothing is done on board the Asia, which could not be done better in an office on shore. If the maintenance of the ship with its cabins gives the Admiralty an excuse for refusing lodging allowances to the officers, the saving thus effected is more than counterbalanced by the cost of the ship. To provide offices ashore for the steam reserve would secure economy in the end, but would entail for the time being an addition to the vote for works. Every board shrinks from an immediate increase in expenditure to secure a future saving.

Stationary ships—Britannia.

War to the knife should be waged against useless hulks everywhere. Taking a few in the order in which they occur in the *Navy List*, the first to which special reference may be made is the Britannia. It is rumoured that the ship will shortly be removed from Dartmouth. The step will be wise in view of the relaxing climate of that confined harbour. It would be a still more effectual measure of reform to establish a school for cadets in a suitable building on shore. Every naval reformer has his own idea as to the situation that should be selected. The northern shore of the Isle of Wight in the bight between Ryde and Cowes offers an unrivalled combination of advantages, good sanitary conditions, a charming country neighbourhood, a wide expanse of sheltered water for boating and cruises in the tender attached to the college, a commanding view of a most important anchoring ground of the fleet, and ready access to our principal dockyard.

The estimates show a total expenditure for the Britannia of £43,000, including the pay and allowances of three lieutenants, and 81 warrant officers, seamen and marines. In a building on shore the greater number of these ratings could be dispensed with.

Revenge.

The flagship at Queenstown is another of the useless hulks which should be disestablished. The present complement of the Revenge is more than 200, including 60 marines, 40 seamen, numerous officers' servants and miscellaneous ratings. Exercise aloft is never attempted. For gun drill a 64-pounder is the only gun mounted on slides. The Revenge will shortly require considerable repair, and this, it may be assumed, no Board of Admiralty would sanction. The Revenge should be withdrawn, and an efficient coast defence ironclad substituted. During the annual manœuvres, the vessel stationed at Queenstown would join the fleet, and the flag officer at Queenstown should command a squadron.

Indian troop ships.

The maintenance and repair of the Indian troopships at Portsmouth dockyard and the consequent diversion of the labour of the workmen, and the attention of the superintending staff from services, which would directly contribute to the strength of the Navy for war, calls for the careful consideration of the Admiralty. The Indian troopships come in for repairs in the summer season, when the dockyards work longer hours and under better conditions for progress generally than in the winter. It is difficult to keep an accurate check on the whole cost of the work on troopships in the dockyard. The labour, in opening dock gates, and transporting and moving from basin to basin, alone constitutes a serious item.

The expenditure on the troopships has not escaped the attention of the native associations in India; and they are able, in support of their own views, to quote the recommendation of the Simla Army Commission. The present arrangements are not economical. Officers and crews are attached to the ships throughout the year, while only employed usefully during the trooping season. In order to test the relative cost of the present arrangement, tenders should be invited from the great English steam companies for the regular conveyance of troops to Calcutta, Madras, Kurrachee and Rangoon.

Since the Indian troopships were established, steam communication with India has been extended. Competition would bring down the conveyance of the Indian reliefs considerably below the cost as now conducted by the Imperial Government.

It is for the Indian Government to consider whether the conveyance of troops in ships owned by the Imperial or the Indian Government should be continued. If it is decided to retain the same vessels, they should be maintained under a running contract with a reliable firm in the private trade. The Indian Government would save expense, while Portsmouth yard would be more free for the proper work of the Navy.

From the Admiralty stand-point, the opportunity of giving sea service to officers and men at the expense of the Indian Government is the only consideration in favour of the system. The 1200 men taken from the Indian troopships would receive a much better training in the ships commissioned for the manœuvres.

Misdirection of labour.

If there is room for improvement in the dockyards, both in the energy and the supervision of labour, reform has been much needed in relation to the application of labour. Naval reformers, keenly alive to the responsibility for creating the utmost possible development of naval power with the means entrusted to them by Parliament, have been disheartened whenever they visited our dockyards, whether at home or abroad, and saw labour so largely misdirected to the unfruitful task of ripping up and reconstructing large numbers of vessels, corvettes, sloops, and gunboats, obsolete in armament and hopelessly deficient in the speed required to give protection to commerce.

Nothing has been so fatal to the efficient working of the dockyards as the frittering away of resources on too many items. In the building of the Trafalgar at Portsmouth we observe with satisfaction the results of concentrated effort. We shall save in many ways by having fewer but better ships in commission.

Obsolete types on foreign stations. Captain Harris, R.N.

It was justly observed by Captain Harris, "We deplore the miserable craft that we call sloops, which can neither sail nor steam. They show the flag in distant ports and carry a fair armament, but their miserably slow speed renders them useless. In war they would have to stow themselves away into some neutral port, and transfer their crews to a fast cruiser or an armed merchant steamer. We have had of late plenty of opportunity for observation, and we say positively that our present sloops and gun-vessels are totally unable to overtake the most ordinary merchant steamer."

Lord Charles Beresford has made public similar views.

Merits of vessels of the older type.

It will be admitted that the class of vessels to which we refer have admirable sea-going qualities, and have done good service in the training of officers and seamen. In point of speed they are not conspicuously inferior to the contemporary ships of the same class in other navies. Looking, however, to the marked advance in point of speed which has been achieved in recent years in foreign navies and in the Mercantile Marine, inferiority in this prime element of efficiency must be regarded as a fatal defect.

Revision of foreign squadrons.

The time has now arrived for a large withdrawal of obsolete vessels from our foreign squadrons. For the protection of commerce, and as a means of maintaining political influence, it is better to hold our naval forces in hand in a state of complete preparation and efficiency, ready to be despatched to any part of the world, where our interests require it, rather than to scatter ships over the globe, at great cost to the country, and without being able to make on any one point an impressive display of strength.

Admiral Aube.

On this subject the opinion of the officers of the French Navy may be appropriately quoted. In his well-known article, contributed to the *Revue des deux Mondes*, in 1870, Admiral Aube thus described and criticised the French system of foreign squadrons: "On foreign stations we usually maintain a frigate, having on board the admiral and his numerous staff, and two or three despatch boats. To each smaller vessel a division of the station is assigned. The frigate lies in the harbour of the capital, leaving it only for an annual visit to the ports of secondary importance. Three years pass by in this service, nearly always at anchor, the only voyages undertaken being of quite limited scope. If service on a foreign station is a school, it is a school of indolence and indifference. Neglect of professional duties and studies is veiled by a deceptive appearance of efficiency. After eight months at anchor at Valparaiso or Rio de Janeiro nothing can be more attractive to the eye than the appearance presented by one of our frigates; the order and the cleanliness could not be exceeded.

"It is not the officers in command of squadrons who are responsible for such a state of things. There are many to whom their enforced inactivity is utterly distasteful. But their movements are fettered by the protests and demands of ministers and consuls accustomed to rely on the presence of our war ships. These men have no appreciation of the necessity for active cruising at sea, in order to train officers and crews. If an admiral absents himself for a time from the centre of the station protests are raised, and complaints are sometimes addressed to the Government at home."

In the view of Admiral Aube, the foreign squadrons maintained under the French flag were as valueless politically as were the well-paid officers of the diplomatic and consular services.

Admiral Jurien de la Graviere.

Another testimony to the same effect may be quoted. It is that of Admiral Jurien de la Graviere. "Our foreign stations," he says, "are a useless and disheartening service. The naval officer in the prime of his youth wastes three or four years in exile in an unhealthy climate. It has been proposed to substitute some system of circulation for the squadrons now permanently maintained on the several stations. It is the general desire of the service. In this wish I heartily join."

Our fleets on foreign stations are severely criticised by M. Weyl, in his pamphlet, 'La Marine Anglaise':—

"The colonial powers, and England more than any other, have numerous ships maintained for the empty purpose of exhibiting the national flag in distant seas, which are useless in a fighting sense. Such vessels may inspire the negro with awe and gratify Englishmen by displaying their flag in foreign ports, but upon the first alarm of war they must disappear from the seas."

Guided by the experience of many cruises in distant waters, I unhesitatingly subscribe to the protests uttered by these distinguished French authorities. France and England are the only powers which attempt to cover the oceans of the world with their vessels of war; and we have carried this unsatisfactory system much farther than the French. It is due to the present Board of Admiralty to say that they are moving in the right direction. The estimates for the present year show an increase of five in the number of corvettes in commission, with a reduction of five in the gun vessels and two in the number of the gunboats. The policy should be to replace, as far as may be, the permanent squadrons abroad by a flying squadron, and to keep in commission a less number of ships of an efficient type in lieu of the inefficient ships hitherto maintained. An occasional visit to foreign ports by an effective flying squadron always makes a telling impression. During the past year a noble squadron of cruisers under the German flag has visited the Cape, Sydney, and the Pacific.

Reports of committees and commissions.

Having dealt with naval administration, as it has been discussed in Parliament during the last session, we proceed to the criticisms of the Treasury, and the reports of commissions and committees.

Expense accounts, 1885–6.

The observations of the Controller and Auditor General on the appropriation accounts for the Navy for 1885–6 are not particularly pleasant reading for those responsible for Admiralty administration during the period under review. Having in the first number of *The Naval Annual* given a personal explanation, I shall not repeat my former statements.

Sir Cornewall Lewis on the art of supervision.

In his methods of observation and reasoning in politics, Sir Cornewall Lewis makes some observations which have a wide application o the administration of gigantic affairs under a parliamentary system:

"In practical politics a large part of that skill which is derived from special knowledge and experience consists in judging how many instances may serve as fair specimens of a class. No man can watch every act, direct every movement, or verify every item of account, in those who are placed under his authority. The efficient exercise of his functions . . . is to carry his examination so far as to have a reasonable assurance that the facts which he does ascertain fairly represent those which he does not ascertain."

Services of permanent officials.

The truth is that every Parliamentary official is on the edge of a volcano. In the quarter least anticipated a failure may occur, and he must bear all the blame for that failure. If all goes well he will certainly get more credit than he deserves. The officials will put in no claim to share in the honours of their chief.

Preparations against Russia.

On the present occasion I would more particularly refer to the services of the high permanent officials. Most ably, earnestly, faithfully, and honestly, did they work for the country in the anxious period of preparation against Russia. The eagerness was intense to make good defects, to fill up stores, and to hurry forward ships for commission. In the immediate anticipation of war it always is, as undoubtedly it ought to be, the paramount consideration to put the naval force into a state of efficiency; and if the ledger is for the moment laid aside, if estimates of indebtedness are imperfect, and if instructions relating to finance (whether from the Admiralty or Treasury) are imperfectly obeyed in a time of pressure and anxiety, public opinion will be indulgent when it is seen that the emergency has been met with timely and well-directed energy.

Whenever we find ourselves face to face with the immediate prospect of war, there will always be found deficiencies to be made good. The circumstances will change with every conflict. Demands will be pressed which could not have been anticipated. On all sides the cry is heard, "Omnia deficiunt ac uno tempore desunt." The ear will be turned to the general in the field, or the admiral in command of a fleet. The Treasury is yielding and its Controller is silent. For the latter the opportunity comes later, when the excitement of war has passed away, and the disagreeable duty alone remains of paying a heavy bill for stores, which have become superfluous, or for services which have not yielded the results anticipated. The Abyssinian, the Afghan, and the Soudan campaigns, are recent and striking examples of the difficulty of keeping an effective check on expenditure during the progress of war. I say advisedly the difficulty, and not the impossibility. It was possible to have complied with all the rules laid down by the Treasury. It ought to have been done.

Hire of cruisers.

The hire of transports and cruisers was the largest item in the expenditure incurred during the Russian scare, and the wisdom and policy of the expenditure were under the circumstances indisputable. The necessity could only have been averted by an expenditure on the construction of fast cruisers on a far more liberal scale than had been thought expedient by previous Boards of Admiralty. The nation had not been aroused, as happily it now is, to the necessity of increasing the estimates to meet a regrettable development of naval expenditure by other powers.

There was delay in paying off the hired cruisers because it was thought politic for the purposes of negotiation to maintain an attitude of instant preparation.

While fully admitting that the vindication of the steps taken by the Admiralty must rest entirely on grounds of public policy, it may not be inopportune to observe that the additional employment to shipping was offered at a period of great depression, and that it is well that shipowners, who build vessels in accordance with Admiralty requirements, should occasionally derive benefit from their liberal and judicious enterprise.

Purchases and contracts.

The system of purchase and contracts for the Navy formed the subject of a recent inquiry by the committee of which Mr. Forwood was chairman. Confining our attention to points of organisation and general administration, the committee made several recommendations, one of the most important of which led to considerable discussion in the House of Commons. The committee recommended that the present duties of the Director of Contracts should be extended to the negotiation of contracts for the building and repair of ships and the construction of engines. In his speech on the Naval Estimates, Mr. Caine strongly objected to any enlargement of the responsibilities already resting upon the Director of Contracts. That official was already responsible for the purchase and testing of naval stores of the annual value of £2,730,000. The purchase of ships and machinery would represent an additional expenditure of £2,464,000. The general and conclusive arguments against the proposal were put forward by Captain Hotham, who on this point was unable to concur with the other members of the committee. He urged that the Director of Contracts, having no knowledge of ships and machinery, must be guided by the opinion of the professional officers of the Controller's Department. The Controller was a Lord of the Admiralty provided with the professional assistance of experts in shipbuilding and machinery. To transfer responsibility from the Controller to the Director of Contracts who could only be in name responsible, must inevitably lead to inefficiency and friction. The same objections apply to the proposal to place contracts for works under the Director of Contracts. The Director of Works is selected from the corps of Royal Engineers, as specially qualified by technical knowledge, and the present Director is a man of remarkable ability. It was proved to the committee that the system of dealing with contracts under his responsibility had worked expeditiously and economically.

Duties of Director of Contracts.

Contracts for works.

Among other recommendations of the committee, the reduction of dockyard manufactures will be generally approved, with this qualification, that the articles must be of a kind which can be purchased with the advantage of competition in the private trade. It would appear from the accounts relating to manufactures in dockyards that the actual cost corresponds very fairly with the rate-book cost, and that the prices in the rate-book are reasonable prices for similar articles as sold in the trades. The appointment of a superior officer as Inspector of Stores is recommended by the committee. Such an officer is very necessary. The Inspector of Stores is to be held responsible for superintending personally the receipt of all stores, a duty hitherto too frequently delegated to workmen only, who cannot be held responsible.

Reduction of dockyard manufactures.

Inspector of stores.

The committee spoke in rather harsh terms of the Engineering Branch of the Admiralty, as deficient in ability to design engines.

Engineering branch.

They suggested that the Department should assume the initiative in the preparation of designs. A change in the direction to which the criticism of the committee would seem to point would be of doubtful expediency. In his report for 1885, Mr. Whitney, Secretary for the United States Navy, rightly observes:—"It is the tendency of all Government servants to fall into grooves. There is no antidote so effective as an appeal to private enterprise. It is difficult to name a single component part of a first-class vessel of war to which private enterprise has not made quite the most important contribution. The iron or steel used for her hull and armour, the machinery, turrets, guns, projectiles, explosives, torpedoes, search lights, steering gear, wire cordage, are almost exclusively the inventions of private individuals and manufactured by private establishments."

Mr. Whitney, U.S.N.

The writer of an able article in *Engineering* remarks that the attitude of the department has always been, and must necessarily be, critical rather than creative. It will have done good service if it exercises a close supervision over work designed and carried out by the contractors who are in keen competition for the designs of the Admiralty.

Dockyard accounts.

The duplication and triplication of returns and accounts is a fault in dockyard administration, which the recent investigations of the committee on dockyard accounts and audit, and of the sub-committees on dockyard returns and stores, bring clearly into view. Deliveries of stores are recorded by clerks representing the principal professional officers, by the clerical staff of the accountants in the yards, and by the clerical staff of the storekeepers. An account of expenditure on labour and stores is kept by the principal officers. A similar account, prepared from the same materials is kept by the accountant of the yard. Certain it is that the professional officers are alone capable of dealing efficiently with a large proportion of the articles and materials supplied to the Navy, and that much tabulation and examination of figures by officers who have no technical knowledge, is practically useless. Neither the accountant nor the storekeeper can check the quality of naval stores, secure economy in their use, or give the necessary orders to contracting firms.

The defects which we criticise in our own dockyards are common to all establishments conducted by Governments. In the reports of the French committees on Navy Estimates, allusion is made again and again to the tendency to multiply returns, and the redundant numbers of the clerical staff. M. Menard Dorian, the reporter of the committee on the Estimates for 1887, in insisting on these reductions, refers to what he describes as the "inconvénients de ce particularisme qui semble être le caractère dominant des divers corps de la marine. Mais c'est ce particularisme qu'il faudrait faire disparaître radicalement.

"L'administration a été bien souvent invitée à étudier la fusion des divers corps secondaires. Sans doute l'invitation n'a pas été assez impérative. Pouvons-nous espérer que la voix de la Commission du Budget sera enfin écoutée ? Nous attachons une importance capitale à cette petite réforme, dont le plus important résultat sera d'amener fatalement la simplification de la paperasserie, simplification inconciliable avec l'existence de corps dont le maintien de cette paperasserie est la principale raison d' être."

Recommendations supported by arguments of so much weight and force, could not remain neglected. It has been decided to reduce the staff of clerks in the French dockyards from 751 to 635, in the department of stores, and from 635 to 515 in the department of victualling.

Supply of warlike stores.

The report of the Royal Commission appointed to inquire into the system, under which warlike stores are obtained for Her Majesty's service, deserves some notice in an Annual dealing with naval affairs.

The armament of the Navy has suffered from the unsatisfactory organisation of the War Office, in relation to the supply of ordnance.

The final decision on questions of the last importance, and requiring a high degree of technical knowledge, has been left to the judgment of a Secretary of State, who is not supposed to possess technical knowledge.

The Commission made two recommendations :

I. The appointment of a commission to lay down a standard as to the amount of stores which should be kept in hand for the public service.

II. The revival of the office of Master-General of the Ordnance. They recommended that the appointment should be held by a soldier of the highest eminence, and that he should be assisted by a council of advice on all technical questions, while the remedy proposed would probably be effectual in securing a good supply of guns.

Director of Naval Ordnance.

A sea officer is indispensable to deal with gunnery questions at the Admiralty. We have such an officer in the Director of Naval Ordnance. The appointment should be filled by an officer of recognised eminence in gunnery; and when a good man has been found he should hold the position for five years, renewable, if it is thought fit in the interests of the public service.

Supply of materials of gun

As to the supply of ordnance, the Commission laid down the sound principle that private enterprise for the manufacture of guns should be liberally encouraged, the Government manufacturing establishments being maintained on a moderate scale, and chiefly with a view to introducing improvements, setting an example of perfection in workmanship and material, and testing prices. While advising that the chief source of the supply of ordnance should be from the outside, the Commission record their favourable impression of the high personal qualifications of the officers who have been engaged in directing the Royal Arsenal at Woolwich.

manufacture from private trade.

French system.

In France, a happy mean has been reached between entire dependence on private works, as in Germany, with the inevitable consequence of subjecting the Government to the caprices and conveniences of one concern, and the contrary plan of entire dependence on Government works, as in France before the Franco-German War. In France, under the new system, the Government establishments are retained, but only as gun factories, in which the parts are assembled. For foundry work dependence is placed on the private industries of the country. Many of these works have found it to their profit to establish gun factories which supplement the Government factories. The French system is strongly commended by the highest military and naval authorities in France, by the author of the 'Histoire de l'Artillerie Francaise,' and by M. Gougeard. "The nation which does not rely on private enterprise to supply the material of war, will soon be distanced in the race by powers which have had the wisdom to secure the support of such valuable auxiliaries." The American Gun Foundry Board recommends the adoption in the United States of the system now pursued in France.

In this connection it may be observed in passing that it is not a little strange that it should have been permitted to a Board representing a foreign Government to publish to the world how great are the resources for the manufacture of steel we possess in the splendid establishment of Sir Joseph Whitworth. It is most unfortunate that the Government has been debarred from taking full advantage of the co-operation of a manufacturer and inventor of great mechanical genius both for the supply of guns and of the materials for the construction of guns.

Ordnance experiments.

The hasty manufacture of large batches of guns without sufficient trial has been the fatal cause of the waste of public money on unsatisfactory armaments. Were a larger margin allowed in the ordnance estimates for experiments, it would avoid delay and lead to economy in the end. There are elements in the construction of ordnance which cannot be investigated by calculation and on paper. The experimental staff at Shoeburyness should be strengthened.

Naval as well as army officers should be attached to that important establishment.

Foreign yards.

Lord Randolph Churchill complained, and with abundant justification, of the waste of money in maintaining useless depots and yards abroad, and of the excessive charge for supervision in those establishments.

Trincomalee.

A few specimen cases have fallen under my personal observation. In the course of my recent cruise I have visited Trincomalee. The estimates show the following charges for the maintenance of this establishment: — Salaries and allowances, £1624; contingencies, £88; wages, artificers, and labourers, £2605; wages, yard service afloat, £146; teams, £8; police, £347; extra pay, artificers afloat, £100; labourers, victualling yard, £161; total, £5079. In a small establishment where the expenditure on labour is under £3000, the salaries for supervision amount to £1624. As an evidence that such expenditure is wholly unnecessary, I might quote this pregnant fact, that the principal appointment at Trincomalee—that of storekeeper of the yard, salary £600—had at the period of my visit been vacant for nearly a year. The duties in the interval had been most efficiently discharged by a clerk in receipt of a salary of £258. The expenditure on supervision at Trincomalee is not by any means fully represented by the amount shown in the estimates for salaries. The residence of the storekeeper is a building exceeding in size the residences of the Admiral Superintendents of our home yards. In a climate where the ravages of insects are most destructive, the maintenance of such a building absorbs a serious proportion of the effective labour of the yard.

Trincomalee is charged with the maintenance of another official residence on a considerable scale for the Admiral on the East India station. The building is in admirable order, standing in an extensive and park-like domain. It contains a handsome suite of apartments suitable for entertainments on the scale usually expected from the governors of our largest colonies. In a remote community, where the society consists of a few officers of the engineers and artillery and four ladies, the duties of public hospitality do not call for a residence for the admiral such as I have described. No inducements should be held out to an admiral to linger in dignified isolation at Trincomalee. As the principal adviser on naval matters generally, and for the defences of the coast of India, his presence must always be more advantageous near the seat of government, or at Bombay. At the latter port a suitable residence is provided, and rightly so, for the accommodation of the admiral.

Viewed with reference to the repairs of the squadron and the supply of stores, the establishment at Trincomalee is equally useless. It possesses neither docks nor workmen, and nothing is done or attempted beyond the building and repair of boats. At Bombay an efficient dockyard is maintained by the Indian Government, and here all the heavy repairs of Her Majesty's ships can be and are carried out.

Giving expression to views strongly impressed by a personal visit, it is my earnest advice to the Admiralty to take the unprofitable items at Trincomalee from the Naval Estimates of the future, and to hand over the yard to the Indian Government, by whom it could be turned to good account for the service of the Indian marine and for the maintenance of the lightships and lighthouses on the coast of Ceylon. Arrangements could be made to provide for the custody of stores sent out to the fleet.

Port Royal.

Having given the experiences recently formed from a visit to Trincomalee, I go back to the earlier recollections of a voyage to Jamaica, where another naval establishment is maintained as useless and more costly than that at Trincomalee. At Port Royal the charge for salaries is excessive in proportion to the expenditure on labour. It is excessive notwithstanding that the salary and allowances of the commodore, who can have little to do beyond the supervision of the dockyard, is not charged against the establishment. In addition to the commodore, the estimates provide four salaried officers and five writers, whose salaries and allowances aggregate £2094. The labour employed at Port Royal under this costly supervision is almost entirely absorbed in patching up the extensive range of worm-eaten timber sheds, many of which are empty and not likely, in any conceivable combination of circumstances, to be used.

Going back to the years immediately preceding my visit, and for which I was able to obtain exact figures, the results of a careful re-tabulation are presented in the following table:—

JAMAICA YARD.—APPROPRIATION OF LABOUR.

Year.	Total amount taken for Labour.	Repairs to Buildings or for other services under the head of indirect charges.	Coalings, conversions, and other Services.	Repairs to Yard Craft.	Repairs to Ships in Commission on Station.
	£	£	£	£	£
1882–83	4,991	3,148	390	674	719
1881–82	4,270	..	..	..	378
1880–81	4,675	..	..	..	703

Other items in the balance sheet of Port Royal were equally unsatisfactory. We had a charge of £1984 for wages for the yard service afloat, the chief duty being to supply water to the barren split of sand and coral on which the naval establishment is placed. The charge for police was £1159, being slightly in excess of the corresponding figure at the extensive yard at Bermuda. The table shows that practically nothing was done at Port Royal for the repair of the squadron. There are no resources for serious repairs, no skilled labour, and few tools. There is no graving dock, and the appliances for careening ships, dating from the past days of brigs and small craft, are obsolete for the maintenance of a steam navy. While Port Royal has thus been suffered to fall into decay, Bermuda, distant only a few days' sail, has been equipped at vast expenditure with the appliances of a first-class naval yard and strongly defended. When the Urgent, the receiving ship at Port Royal, was last required, she was partially rigged and towed to Bermuda. It is evident that a turning point has been reached in the history of Port Royal. Of two things one. The yard should be closed or made efficient. Rotten sheds must be pulled down. The machinery must be increased, a graving dock provided, and water supplied by iron piping in lieu of the worn out tanks at present in use. To do these things perhaps half a million is required. Are we prepared for this expenditure? If objections are raised to the closing of Port Royal in view of the progress of work on the Panama Canal, it may be urged in reply that the most sanguine estimates give eight years before completion, and that the Admiralty of the day may be trusted to take proper steps to defend British interests. Our course of action must be decided in the light of existing facts, and all the circumstances of the present time seem to point to the conclusion that the yard should be closed as an Admiralty establishment and handed over to the Colonial Government.

Storeship Liffey.

The maintenance of the storeship Liffey at Coquimbo is another unprofitable item. The Liffey was fitted out for store service in 1879, at the preposterous cost of £30,500. The cost of maintenance is approximately as under:—Pay of officers and men, £3210; victualling and allowances, £1000; depreciation, £3000; total, say £7000. When sounder views as to the distribution of the ships in foreign squadrons find acceptance, it will be more useless than it is at present to keep a depot for naval stores at Coquimbo. In these days of large facilities of transmission and supply, it may be confidently left to the commercial experience of the present able Secretary to the Admiralty to provide the Fleet on the coast of South America with stores without putting the country to the expense of a floating depot.

Ascension.

The establishment at Ascension is an inheritance from a period when the slave trade was actively pursued on the West Coast of Africa, and a numerous squadron of brigs and small cruisers was maintained by the British Government for its suppression. Ascension was, in those days, of great value to recruit crews stricken down with fever. The present establishment is no longer required as a sanatorium for the Navy, and looking to the broad fact that Ascension is useless as a support to the Navy, and that the officers, seamen, and marines doing duty on the island are unwisely withdrawn from the force available for manning the Navy, it may be questioned whether it is worth maintaining as a depot for stores.

As a coaling station, in the event of trade being diverted in time of war from the canal to the route by the Cape, Ascension, from its geographical position, might be valuable. In considering the question of its retention as a naval station, it is impossible to put aside the expenditure of the past. Spacious storehouses have been constructed, of almost unnecessary solidity. Excellent hospitals have been built on the sea-level, and on the summit of the peak. Under careful management vegetation is spreading, and the pasturage is already sufficient to feed 3000 sheep, and unlimited supplies of fruit and vegetables could be raised. It might be worth while to charter a schooner for a year, and to see what could be done to supply the vessels on the West Coast of Africa with fresh meat and vegetables.

Ascension is easily defended. Landing on the island is only practicable in ordinary weather on a pier, under the fire of machine-guns. After two days devoted to personal examination, I arrived at the conclusion that a reduced naval establishment should be retained, that additional armament should be supplied, that the number of Kroomen for agricultural work should be increased, and that some inexpensive means of keeping up a communication with ships on the West Coast should be arranged.

A tribute of praise is well-merited by the naval officers at Ascension for the zeal with which they devote themselves to their duties in an isolated position, where the morale of an ordinary landsman would break down from ennui.

In concluding this section, I desire to say that, while anxious to support every reform which gives promise of good results, and believing that there is much to be done, my experience at the Admiralty has left on my mind a far more favourable impression of the office than is generally entertained by the public, who hear of nothing that is done unless it happens to go wrong. Officers in the executive line of the Navy are universally popular. Their gallant deeds are before the country. Civilians are less fortunate. The work they do is little known, and rarely appreciated at its true value. Obliged to endure in silence the weight of criticism, for the most part wholly unmerited, and always more severe than they deserve, they may perhaps console themselves with the reflection of Marcus Antoninus, that it is royal to do good and be abused. The irresponsible critic from the outside generally has the best of it with the public. It was sagaciously remarked by Priscilla to Silas Marner, "It is a deal the best way of being master to let somebody else do the ordering, and keep the blaming in your own hands."

It may be pleaded for the naval administrations of all nations that they have been hopelessly baffled in their efforts by the progress in the art of destruction. In the desire to keep ahead of the developments of power under foreign flags, the Navy is, perhaps, too ready to condemn every ship which is judged inferior to the latest production of the foreign constructor. There is a tendency to exaggeration in professional criticism. Indiscriminate charges of wasteful expenditure and extravagance render people sceptical as to the progress which is really being made in strengthening the Navy. The taxpayer is discouraged by doubts as to the judicious application of public money. Foreign powers, if they had no independent means of observation, might be led to estimate lightly the forces which we are able to put forth. "To talk of maladministration of the Navy in the way which is so common in this country," wrote Mr. Greville, "is to make our alliance appear not worth having, and to make all other nations have no fear of our hostility." The interval of a generation since these wise observations were penned has seen no improvement.

Results obtained under foreign naval administrations.

If we turn from the British Navy to the fleets of foreign powers, we find disappointment at the inadequate results from expenditure expressed with equal unanimity by officials and by independent critics. The late M. Gabriel Charmes writes, in accents of despair:—"When one studies closely the state of our (the French) Navy, one is alarmed at the magnitude of the work to be undertaken, not to effect a complete change, but to make use of it in its present state. No problem has been solved, no decision taken." In his report for 1885, the Secretary of the United States Navy paints the situation in the gloomiest colours. "Since July 1868 over 75,000,000 dollars have been expended on the construction and repair of vessels. We have practically nothing to show."

Sir Charles Dilke believes that they have done better in Italy. It is, he says, a puzzle to any civilian mind how Italy, spending only one-fifth what we spend, can produce so noble a muster of big ships. The answer is to be found in the slow rate of progress to completion. The Duilio, the first of the new class, was launched in 1876, and only three ships are as yet completed. It is said that the boilers of the Duilio and Dandolo are beginning to fail. It is further to be observed that the entire naval expenditure of Italy is devoted to building, that the fleet in commission is inconsiderable, that there is little practice at sea, and that no foreign squadrons are maintained. The charge for repairs is brought to the lowest point, and it may be doubted whether such economy is consistent with that efficiency which can only be gained by experience at sea.

CHAPTER III.

MANNING OF THE NAVY.

Men required and available.

HAVING dealt with the aggregate expenditure under Navy Estimates for 1887–8, the vote for men calls for some observations.

Captain Johnstone, R.N.

The requirements of the fleet, and the numbers available in the several ranks were carefully estimated by Captain Johnstone, R.N., in an able essay to which the prize of the Royal United Service Institution was awarded.

The results of his examination were tabulated as on opposite page.

Captain Johnstone reckons on one half only of the Naval Reserve as immediately available. There is reason to believe that we may rely on a much larger percentage within a short interval after the outbreak of a war.

Increase of 1000 Seamen.

The present board have raised the strength of seamen by 1000. As to the value of these highly trained men there cannot be a question. It must, however, be impracticable to meet the strain of a protracted conflict from the permanent forces of the Navy. It costs £300 to train the boy entered for the fleet into the finished seaman; and he becomes entitled to a liberal pension at an early age. Considerations of expense impose a limit on the permanent force of the Navy. For manning the fleet in time of war, we must rely on a Naval Reserve, and the Admiralty must look to it that the force is efficient. If they are satisfied with the force as at present constituted, it would seem better to have added 5000 men to the reserve than 1000 to the standing force. The complements required for ships commissioned in peace could still have been furnished without adding to the strength of the permanent force, by taking men out of the stationary ships and from the harbour billets, in which many stowaways are still to be found.

It is natural that naval officers should prefer men trained under their own admirable system, to men brought in from the Mercantile Marine, who will certainly have much to learn when they first enter

TOTAL NUMBERS REQUIRED. FLAG OFFICERS NOT INCLUDED.

—	Post-Captains.	Commanders.	Lieutenants.	Sub-Lieutenants and Navigating Sub-Lieutenants.	Navigating Officers.	Midshipmen.	Gunners and Boatswains.		Medical Officers.	Accountant Branch.	Carpenters.	Steam Branch.				Total.	Marines.	Other Ratings.	Complements.
							Charge of Stores.	Quarter-deck Duty.				Officers.	Engine-room Artificers, &c.	Leading Stokers.	Stokers.				
Seagoing fleet	83	199	653	384	288	324	388	44	380	446	100	525	1,130	1,208	5,348	11,500	7,747	31,626	50,943
Coast Defence Vessels .	6	..	46	2	10	..	56	..	8	8	6	58	95	100	281	676	402	1,642	2,720
Transport Vessels . .	12	6	67	6	17	..	17	50	18	31	11	57	68	90	386	836	395	1,560	2,791
Employed at Home . .	17	54	108	..	25	..	61	43	80	82	24	52	48	54	211	859	529	2,817	4,205
Ditto Abroad .	7	5	14	..	11	..	31	..	37	23	8	22	31	15	54	258	148	662	1,068
	125	264	888	392	351	324	553 137 690	137	523	590	149	714	1,372	1,467	6,280	14,129	9,221	38,377	61,727
Boys under training .																			2,200
Personnel required .																			63,927

OFFICERS AVAILABLE.

—	Post-Captains.	Commanders.	Lieutenants.	Sub-Lieutenants and Navigating Sub-Lieutenants.	Navigating Officers.	Midshipmen.	Gunners and Boatswains: Charge of Stores.	Gunners and Boatswains: Quarter-deck Duty.	Medical Officers.	Accountant Branch.	Carpenters.	Steam Branch: Officers.
On the Active list . .	165	208	795	188	187	*318	677		345	470	182	636
On the Retired list . .	80	80	40	..	40	..	10		50	20	5	40
Royal Naval Reserve .	..	..	*18	*10	60	*40	..		..	..	..	1
Temporary	..	..	..	..	20	..	..		20	20	..	25
	245	288	853	198	307	358	687		415	510	187	702
			*843	*208		*318						

ABSTRACT AS TO THE OFFICERS.

—	Post-Captains.	Commanders.	Lieutenants.	Sub-Lieutenants and Navigating Sub-Lieutenants.	Navigating Officers.	Midshipmen.	Gunners and Boatswains: Charge of Stores.	Gunners and Boatswains: Quarter-deck Duty.	Medical Officers.	Accountant Branch.	Carpenters.	Steam Branch: Officers.
Required	125	264	888	392	351	324	690		523	590	149	714
Available	245	288	843	208	307	318	687		415	510	187	702
Surplus	120	24	..	..	..	..	..		..	..	38	..
Deficiency	..	..	45	184 45 229	44	6	3		108	80	..	12

AVAILABLE IN ALL GRADES.

Officers, Seamen, and Boys . .	44,850	
Marines	11,000	
Royal Naval Reserve . . .	9,000	
Seamen and Marine Pensioners .	2,000	
Royal Naval Artillery Volunteers	1,200	
Retired Officers (not Flag) . .	365	
Temporary Officers	85	
	68,500	
Deduct 2 per cent. on 40,000 for casualties	800	
Total available .	67,700	67,700
Total required		63,927
Surplus . . .		3,773

* See explanation following the table.

the Navy. Trouble must, however, be given ungrudgingly where the interests of the country are at stake. It is highly desirable that the Navy should be manned on a more expansive and elastic system than at present. The British Navy is the only Navy where the ships are manned with a body of men all of whom have been trained to the service from boyhood. In the fleets of the continental powers, the system of conscription causes a rapid flow of men in and out of the service. The ships are full of raw hands and the work of training is continually going forward. The question of reserves of the Navy will be dealt with in more detail in the section devoted to naval mobilisation.

Increase of the Marine force.

The whole question of manning the Navy must at an early day be reviewed in connection with the revolutionary change in the character of our ships. Masts and sails are disappearing: guns are being worked by hydraulic power; boats are driven by steam. The seaman's art is being applied to rigging out torpedo nets and laying counter mines. In these altered conditions marines or marine artillery may be trained to take a more general share in the duties of a man-of-war. Their instruction begins later and involves considerably less expense to the country than that of the blue-jacket, who is taught many things which he will have few opportunities of turning to account in the course of his service in a mastless ironclad. It is owing chiefly to the late entry that the recruitment of the corps of marines is less expensive than the raising of seamen. With the great advance which has taken place in the public education, it should certainly be possible to enter young men, at the age fixed for enlistment in the Marine Artillery, with sufficient education to enable them to go through the course of instruction in a gunnery ship or a torpedo school.

In a not far distant future we may expect to see the present force of marine artillery considerably enlarged. The officers of the latter force may be lieutenants of the Navy, the list being strengthened to meet the new demand. The marines may remain as at present, in barracks. Their training in gunnery and the torpedo may be received side by side with seamen, and in the same drill-ships. The dress will probably be better adapted than at present to freedom of movement. If something is lost in precision of movement on parade, the marines will gain in efficiency for duty on board ship. In our masted ships the full complement of seamen will be retained. But as our mastless ships increase, so we may rely more largely than at present on that splendid amphibious force which has been created in the marines.

The blue-jacket is not doomed to disappear. He will be retained because the thorough seaman must always remain indispensable. The change, anticipated in the preceding observations, will be limited to a re-adjustment of numbers, as between the blue-jacket and the marine artilleryman.

Special rating of captain of gun required in the Navy.

A point of importance in connection with training in gunnery is raised by Captain Harris in his last essay:—"At each of our gunnery establishments, in addition to the present very satisfactory course of training, we have persistently advocated a more severe course of instruction in firing heavy guns at sea against moving targets. With a heavy armament the value of a well-delivered shot is worth one hundred times its former value. It may actually decide an action. A seaman who is captain of a big gun and combines a well-trained hand and eye is worth any wages. Our future captains of heavy guns must be specialists. It is not given to everyone to be a good shot in the sporting field, while to others it is innate. It is the same in the working of heavy guns."

General training.

In the British Navy the general system of training in the ships has been brought to ideal perfection by the efforts of many able officers, who have devoted themselves with rare zeal and intelligence to the work. At the next stage in his career the young seaman has hitherto been placed in a position of temptation, which has often marred the good work of the training ship. He has been turned over to a receiving ship in the home ports, where the supervision is necessarily less strict, where he is exposed to the bad influences of the shore, and where he has been allowed to remain for months before being sent to a sea-going ship. The result was lately described by Sir Edward Fanshawe:—

"Whilst I was at Portsmouth there were 400 young ordinary seamen at one time in the flag-ships, of whom, on leaving their training-ships, there were not more than one per cent. who had not got 'very good' certificates; of these 400 young seamen I think about one-fourth had already got into second-class for conduct."

The training squadron, which, as it will be observed with general satisfaction, the present Board has resolved to retain, offers the best remedy for this great evil of detention at an early age in a harbour ship. The training squadron returns to the home ports two or three times a year, and there should be no difficulty in securing that all boys of the first class, on passing out of the training ship, are sent at once to sea-going ships. It is, as was remarked to me by Captain Bradshaw, when at the head of the training service, what they look forward to and what they enter for. It should be arranged that the boys, who are ready for sea, should remain in the training ships until they can be turned over into the flying squadron. Many other means will occur to the naval mind as a remedy for the great evil of a long detention of young seamen in the home ports. When the ironclads of the Agincourt type succeed the Duke of Wellington and the Royal Adelaide as receiving ships at the ports, they should be regarded as sea-going ships, and taken to sea for forty-eight hours at least once a fortnight during the cruising season. An occasional cruise in the Channel would be beneficial alike to officers and men.

Length of commissions.

Passing from the stage of training to the general conditions of service at sea, the commissions of Her Majesty's ships are still not unfrequently prolonged for a period of four years. It would be a boon to the Naval Service if we were to adopt the German rule, relieving men serving on distant foreign stations every two years. When the German Training Squadron recently visited Sydney, every man who had been more than two years in the squadron was sent home. There is no necessity for calling upon officers and men for those hard sacrifices, which were more or less unavoidable in the former days of slower communications. Absence for three, four, or five years is a great hardship. For the elder men it is a cruel severance of home ties; in the young men it does not strengthen patriotism.

> "Men without country, who, too long estranged,
> Had found no native home, or found it changed."
> Byron—*The Island*, Canto 1.

The present system is maintained on the ground of economy. If it tends to make naval service unpopular it is a doubtful economy. Advantageous terms can be negotiated, in connection with the mail contracts, for the conveyance of reliefs to foreign stations. The reliefs for the German squadron which recently visited Sydney were conveyed by the subsidised steamers running to Australia under the German flag. By making use of the facilities now offered in the Mercantile Marine, the necessity of keeping up such vessels as the Orontes and the Tamar could be avoided. The saving would go far to cover the charges for the conveyance of men by the ordinary steamers, and thus a boon might be conceded without putting an additional charge upon the estimates.

Cost of reliefs.

Special vessels for reliefs on Australian station.

If it were thought desirable for purposes of training to send out reliefs to the Australian, Pacific and China squadrons in ships carrying the pendant, vessels suitable for the service should be employed. Two auxiliary screw sailing ships, of 3000 tons displacement, fully rigged clipper-ship models, with sufficient power to steam eight to ten knots in a calm, would be suitable for the purpose. No attempt should be made to introduce a serious armament. Adding some details from a letter received from Lord Alcester, when in charge of the difficult negotiations successfully conducted in the Bocche di Cattero, they should have poops for the accommodation of officers, the gun-room officers messing in the ward-room, but with their own mess to live in, longer top-gallant, forecastles, cables working on the upper deck, and the crew messing on the main deck, which should be fitted with large air-ports and not for guns.

The tendency of the day is to treat sailing-power with contempt. In former times, when sailing-vessels afforded the only means of maintaining distant communication, great results were obtained by vessels skilfully designed for fast sailing, manned with strong crews, and capable of spreading a large area of canvas. The Lightning accomplished her outward voyage from Liverpool to Melbourne in sixty-four days, and the return voyage in sixty-two days. The art of building sailing-ships is not lost.

In the French Navy the training of seamen in sailing vessels is pursued with much confidence in its value. On the 20th August last a sailing frigate, the Melpomene, of 2000 tons displacement, was launched at Rochefort to replace the Resolute, the former training-ship for seamen. A sister-ship to the Melpomene is under construction at the same port.

Age for coast-guard.

In connection with the manning of the Navy, the age of admission into the coastguard seems to call for consideration. It is a question whether the men are not allowed to leave the service afloat too soon. If a longer term were required, men would have had a more thorough training at sea before entering the reserve, while a greater inducement would be held out to enter for a second engagement in the Navy.

Commissions to warrant officers.

The promotion of two warrant officers, Mr. James Webber and Mr. Richard A. Cathie, to lieutenants' rank is an incident of the year which will command general approval. The warrant officers of the Navy merit recognition not less than the non-commissioned officers of the Army.

Lieutenants, R.N.

In the last session the position of the lieutenants of the Navy was brought before the House of Lords by Lord Sudeley, in one of those painstaking speeches which he has from time to time delivered in both Houses of Parliament on subjects connected with his old service. The lieutenants at the present time labour under a two-fold disadvantage. Not more than two out of nine reach the rank of commander; while the authorised number of lieutenants being 1000 and the actual number 873, it is impossible to allow any special retirements. Lord Sudeley would administer consolation by an increase of pay on eight years' seniority. Lord Elphinstone, on behalf of the Admiralty, announced an increase in the commanders from 225 to 270 by annual additions of seven to the existing list. This would give promotion to two lieutenants in seven.

The lieutenants of the Navy are officers of the highest merit. They are often called upon for hard and dangerous service. The qualifications required embrace a wide range of practical and theoretical knowledge, in seamanship and steam, gunnery and navigation. To these let us add tact and judgment. No just grievance affecting the lieutenants should be suffered to remain unredressed.

Engineers R.N.

The country will be not less ready to be liberal in its dealings with the engineers of the Navy. New responsibilities are being continually thrown upon the mechanical officers through the extended use of hydraulic and steam machinery in the working of mastless ships, and through the introduction of the torpedo. All claims which may arise in connection with these changes should be promptly met, and the acknowledgment should be given by special rates of charge pay, rather than by a general increase without regard to the duties performed.

Marine commands.

In dealing with the manning of the Navy, the position of the officers of the marines demands consideration. This fine corps suffers from the want of those prizes and prospects of advancement which are open to the Army and to the Executive line of the Navy. It would be an act of justice to reserve one or more of the commands held by general officers of the Army for generals of the marine forces. Foreign stations, such as Bermuda, Jamaica, or Hongkong; home commands, such as Plymouth and Chatham, intimately associated as they are with the Navy, might be given, from time to time, to marine officers with the claims of good service in the field.

CHAPTER IV.

NAVAL MOBILISATION AND DEFENCE OF COMMERCIAL HARBOURS.

THE new development given to the Intelligence Department is a feature in the naval administration of the year. Credit for the extension of this important branch must be attributed to Lord Charles Beresford; but the public ought to know that before that gallant and popular officer took up the subject, the work of collecting and combining all the information in the possession of the Admiralty had been going forward under the direction of Captain Hall. I can certify from personal knowledge to the method and completeness of the work. When the active operations of war were undertaken on the Nile, and were contemplated in the Baltic, the Intelligence Department responded, in a manner highly creditable to the officers concerned, to the sudden and large demands which were made for minute and accurate information.

Lord Charles Beresford's memorandum.

The private memorandum prepared by Lord Charles Beresford for the consideration of the Board of Admiralty was an unauthorised publication, and the administration of the Navy was criticised in a tone which would not have been adopted in a paper intended for publication. It is the duty of every naval officer, and especially of those who fill responsible positions at the Admiralty, to scrutinise with ceaseless vigilance. Where they see defects they should propose reforms. It is not less a duty to uphold the influence of England and to impress on foreign nations a wholesome dread of the power of her fleets and armies. By skilful conduct and brave deeds Lord Charles Beresford has done his part in sustaining the naval renown of his country. He cannot desire to weaken it by exaggerated criticisms. It was evident from the terms of his memorandum that the gallant officer himself was not dissatisfied with our naval position in its main features. It was not for greater activity in shipbuilding, or for a more numerous permanent force of men and officers, nor for additional naval stations abroad that he pressed. It was on the want of a perfect scheme of mobilisation that he chiefly insisted.

From the dawn of modern history downwards it is impossible to recall a time when reproaches have not been heaped upon the Admiralty. The present occasion is the first in which it has been seriously suggested that, if a sudden emergency arose, the naval members of the Board would be unable to make instant and effective use of all the resources at their disposal. Such a charge cannot be sustained by our experience of the past. When, after a long peace, the country was suddenly plunged into the Crimean War, no deficiency was shown in power of naval mobilisation. We were lacking in ships adapted to the work which the Navy was called upon to do, in armoured ships for bombardment, and in gunboats of light draught for the Baltic. Our mobilisation was not defective. On a recent occasion Lord Charles Beresford himself acknowledges the promptitude with which the deficiencies of the Navy in cruisers were made good by the department immediately concerned, and which had prepared itself for such an emergency by previous careful examination of all suitable ships in the Mercantile Marine. To admit that the organisation of the Admiralty for war was so inefficient, as unprofessional readers might be led to infer from a perusal of the memorandum, would imply a charge of extreme gravity against a long line of able, distinguished, and devoted naval officers, who have served at the Admiralty. Mobilisation, that is to say effective use of such resources as exist, depends in the main on them. On Parliament and on the Government of the day the responsibility would rest for parsimony in crippling the resources of the Navy. If we are wanting in ships, or deficient in men, the government of the country must bear the blame. If our mobilisation were defective, the responsibility would lie with some of the best officers of the Navy in the present and the past.

Intelligence Department under Captain Hall, R.N.

In dealing with the subject of organisation, Lord Charles Beresford submits for the consideration of his colleagues as his principal proposal a considerable development of the Foreign Intelligence Department. In pressing for the acceptance of his own excellent recommendations in a minute prepared for circulation in office he was not called upon to do that justice to the officers who had served in the Intelligence Department which, in a document of a different character, he would gladly have rendered. No officer could have worked more assiduously than Captain Hall. It was under his direction that the Intelligence Branch was first established, and he was assisted by officers with a devotion and ability equal to his own. As a result of their labours, the Admiralty was already in possession of a large mass of information, methodically tabulated and digested, and embracing within its range the whole habitable globe. To give this well-merited praise to Captain Hall and his subordinates is not to question the merits of the plan recommended by Lord Charles Beresford. There is much more good work to be done, and the reinforcement of the department by the officers of exceptional ability who have been selected for the service cannot but strengthen the Admiralty in that power of prompt and effective action in an emergency, for which Lord Charles Beresford has rightly expressed anxiety. The Intelligence Department does the work of Chief of the Staff for the Navy.

Approval of Lord Charles Beresford's proposals.

In connection with the Intelligence Branch, it may not be superfluous to point out that much may be done to establish more intimate relations with the sister service. If the Admiralty have information in their possession which would be valuable to the Army, and if the Army have information which would be valuable to the Navy, and there be neglect on either side to convey such information to the other, the public service suffers. This should be closely watched by Lord Charles Beresford and his colleagues.

Joint action, Admiralty and War Office.

Turning from the Intelligence Department to the force available for manning the Navy, the deficiency in the number of lieutenants must always be felt when the Navy is placed on a war footing. To increase the permanent strength of lieutenants is not desirable. In peace it is not possible to give to a largely increased number sufficient sea service, or reasonable prospects of advancement. The immediate requirements of a war would be met by the promotion of sub-lieutenants and warrant officers, and by handing over all non-fighting ships to officers selected from the Mercantile Marine.

Numbers available for manning the Navy. Lieutenants. First steps in war.

While, however, the Navy possesses in itself considerable elasticity, the best officers in the Merchant service, and it has many well able to render aid to the Navy and to the country, should be selected and trained to do duty in the fleet. In the enrolment and training of officers of the Royal Naval Reserve the arrangements have until recently left much to be desired. More care should have been taken in the enrolment, more pains should have been bestowed on the training. The entry of officers for the Naval Reserve is a duty of great importance, and it is difficult for officers holding other appointments and commands to keep touch with the Mercantile Marine. The captains of the Reserve ships are in the best position for this purpose; but they have many duties, and it may be found desirable hereafter to appoint retired officers of rank to the principal ports whose special duty it should be to direct the action of the shipping masters and the Mercantile Marine associations in the selection of

Lieutenants, R.N.R.

young officers coming on in the Merchant service, whom it might be for the public advantage to attract into the Naval Reserve.

The regulations for the entry of officers for the Naval Reserve have recently undergone judicious revision. The Admiralty and the Naval Reserves office deserve credit for the pains devoted to this important task.

Training of officers, R.N.R.

Passing from the entry of officers to the training, something is needed beyond the instruction which can be gained for twenty-eight days in a drill-shed. It is a useful preliminary, but it should be carried further. This has been duly considered in the new regulations. Officers of the Naval Reserve have now an opportunity of passing through a short course in the gunnery or torpedo school, or embarking in the fleet during the evolutionary cruise which will now probably take place annually. It only remains for the Admiralty to encourage the officers of the Naval Reserve to avail themselves of the facilities now afforded, whether by a payment on passing through such an examination as would be a satisfactory test of efficiency, or by making promotion conditional on passing through a certain course of instruction.

Temporary service in commissioned ships.

The provision enabling officers of the Royal Naval Reserve to serve a year in the Navy, with an annual retaining fee on the completion of their service, will, we may hope, attract a considerable number. It will be noted with satisfaction that one officer has already entered in the Colossus. Should officers be appointed to watch over the interests of the Naval Reserve in the large ports, they would have an opportunity of exerting valuable influence in inducing lieutenants of the Naval Reserve to respond to the invitation which has now been given from the Admiralty.

Training of seamen, R.N.R.

Passing from the training of officers to the training of men of the Naval Reserve, every opportunity should be taken of extending it beyond its limited range in the drill ships. When a large fleet is commissioned for the annual manœuvres the complements should include some proportion of Naval Reserve men. It would be a mark of the confidence of the Admiralty, and be useful as a test of efficiency. It is to be regretted that the Naval Reserve were not called out on the occasion of the Jubilee review, and for the subsequent manœuvres.

Engine-room complements.

Among the suggestions contained in the memorandum of Lord Charles Beresford, that relating to engine room complements particularly deserves attention. It is obvious that we have not a sufficient staff of engineers, or a sufficiently numerous body of stokers to man the Navy in time of war. For reinforcements we must look to the Mercantile Marine. We were so reinforced during the Russian scare. As each troopship and transport and cruiser was taken up for the public service, the engine-room staff were invited to volunteer for service, and to a man responded to the call. Lord Charles Beresford truly says, "the duties of the engine room require skill and experience." It is certain that no officers and stokers fortuitously selected from the Naval Reserve would have been so efficient to take charge of the engines of the cruisers hired for the Navy as those who had been long serving in the several vessels. We may anticipate the same patriotic answer to all future appeals. If this should be the case, the establishment of a large reserve of engineers and stokers becomes a matter of less urgency than would at first appear. It is nevertheless a highly desirable step. If for no other purpose, it would be valuable for the impression of preparation it would tend to create abroad.

Strength of Naval Reserve.

Turning to the strength of the Reserve, it should be raised to 40,000, in conformity with the too long neglected recommendation of the Manning Commission. This number would be inclusive of stokers, of that valuable second-class reserve for which our fisheries, carried on with so much hardihood and enterprise from the Nore to the Hebrides, supply an inexhaustible recruiting ground, and the Volunteers.

The best men among the 80,000 of French Inscription Maritime are recruited from their fisheries. The number of their reserves is made up by including landsmen with the slenderest acquaintance with the things of the sea. The want of a seaman's experience is perhaps less felt in these days of steam. It justified the suggestion put forward in another section for a considerable augmentation of the Marine Artillery.

The employment of seamen in the Mercantile Marine does not increase, and is not likely to increase, but there are large numbers thoroughly eligible for the Naval Reserve who have not joined. The terms offered being already so liberal, any increase of the present retainers cannot be recommended.

Royal Naval Artillery Volunteers.

The Naval Artillery Volunteers are greatly indebted to the present Board for the wise decision to give a capitation grant on strict conditions as to efficiency. They took part in the Jubilee review, and in the march past before the Queen at Buckingham Palace.

In a Paper read by Admiral Arthur before the United Service Institution in 1886, it was wisely recommended that the Royal Naval Artillery Volunteers, hitherto a somewhat isolated force, should be more directly associated with the coastguard for coast defence, that they should be embarked in the first reserve squadron when assembled for the annual exercises, and employed in patrolling the coast when the coastguard are embarked for their annual course. As to numbers, Admiral Arthur recommended that every port in the kingdom should be invited to raise a battery of 60 or 80 men for local defence. Sir George Elliot asks for a much larger number.

The organisation of the Royal Naval Volunteer forces will require further careful consideration. Experience will probably show that efficiency will be best secured by an organisation in two divisions.

The men selected for the torpedo service should be specially trained in steam launches, which should be attached to certain harbours for purposes of instruction. A capitation grant should be paid on a higher scale for thoroughly efficient torpedo boatmen.

The Naval Volunteers of the artillery division should receive their training ashore and afloat, as at present.

The maximum strength of the Royal Naval Artillery Volunteers should be fixed at 5000; to be hereafter increased, when their line of duty in connection with the Navy has been more completely determined.

Drill of Naval Reserve abroad.

In connection with the Naval Reserve the establishment of places for drill in India and the Colonies seems highly desirable. During my recent cruise I have been impressed by the unfortunate position of British seamen detained in our Indian and Colonial ports without occupation, or any means of earning pay or filling up idle time. It would be a great boon if facilities were given to Naval Reserve men for putting in their drill during these intervals of enforced and most unprofitable and detrimental idleness abroad. A scheme has been put forward by a Calcutta correspondent which seems feasible and practical. He proposes that Government should make such arrangements as would enable seamen of the Royal Naval Reserve and Volunteers belonging to any corps of Royal Naval Artillery Volunteers to put in their course of drills or portions of their course at any British port of consequence in the world. The staff required for the work of instruction need not be numerous. My correspondent supports his suggestion by arguments which will commend themselves most strongly to those best acquainted with the circumstances:—

"In peace time at all ports, except in very exceptional seasons of great mercantile prosperity, ships have to lie up waiting for cargo or repairs; and at most ports (and at all eastern ports), healthy amusement for seamen, after working hours, is wanting. Time hangs very heavily on the crews' hands, and want of something to do very often leads Jack astray. What a splendid opening volunteering would be for healthy and useful amusement-work, and letting off the steam which is always generating and blowing away in profusion where it is not wanted.

"If sufficient opportunities were given by Government to naval volunteering, there is no doubt but that the seamen would take advantage of them to the utmost. They would have a large reserve of *sailors* trained in gunnery, and requiring very little to bring them up to par. And in the event of war, cruisers with first-rate crews might be fitted out in every British port, where ten or twenty British ships were collected.

"I need only adduce the instance of the Calcutta battery of Naval Volunteers to show what a state of efficiency naval volunteers may be brought to. A team of this battery called forth the highest admiration from Their Excellencies the Viceroy and the Commander-in-Chief at the recent assault-at-arms on the Maidan, where the volunteers were only three seconds behind a team of the regulars in dismounting and mounting a gun. And at the annual inspection of the Presidency Volunteers last month, the general commanding the Presidency division, himself a gunner, especially noted in a most eulogistic manner the efficiency of the Naval Volunteers who were present.

"W. R. H.

"CALCUTTA,
"*March* 1887."

Colonial Naval Reserves.

In connection with naval mobilisation the organisation of a Colonial Naval Reserve is a question of high importance. The subject of a Colonial Naval Reserve is introduced in Captain Johnstone's essay with the following observations:—

"Though last in order these are not least in importance. The question of defending the empire, and with that object of the consolidating of the whole of its forces, is daily pressing itself more on public notice, and is of ever-increasing moment. The relative positions of the dependencies and of the mother-country have undergone greater changes during the present generation than at any previous time; the Colonies are no longer in the condition of children wholly dependent for protection on their parents, but are now, so to say, reaching manhood, and are ready, either in close union with the parent State, to defend the common interest, or, whilst withdrawing entirely from the paternal control, to remain in close bonds of union and friendship. What the connection is ultimately to be it is for statesmen to decide, but it seems certain that if the United Kingdom is itself to continue to exist in vigour, and not to retire into declining old age—content to see its glories continued in its offspring—consolidation or confederation, and not separation, will be the object of its policy.

"Until steps are taken to organise its entire forces in one comprehensive scheme the defence of the different parts of the empire will be conducted in a wasteful manner, from the points of view of men of money, or of *materiel*. In the absence of such organisation, this loss being inevitable, it is necessary to accept existing facts, and to examine, as far as possible, what are the resources in the present state of affairs."

All the colonies peopled by the British race possess great maritime resources. The mercantile marine of Canada boasts of 7315 vessels, aggregating 1,231,856 tons. It is believed that the number of seafaring men in the Canadian Dominion may be taken at little short of 100,000. We may add not less than 25,000 men employed in fishing on the coasts of Newfoundland and Labrador.

The enrolment of a naval reserve for Canada was strongly urged in a former publication by the present writer; and a plan was proposed for the periodical drill of the men in gunboats, calling at the several ports. Steps have recently been taken by the Colonial authorities to raise a naval defence force. The supply of recruits is practically without limit.

Australasia has a Mercantile Marine of 2200 vessels, aggregating 274,014 tons. The merchant fleet of New Zealand includes 431 sailing vessels of 59,717 tons, and 161 steamers of 36,170 tons. The effective organisation which has been created in the Australian colonies both for sea and land defence is described in the section dealing with colonial defences generally.

The Admiralty should do everything in its power to foster and promote the Naval Reserve and the Naval Volunteer movement in the colonies. Gunboats, officers, and instructors should be liberally supplied. A Colonial Naval Reserve of 10,000, backed by 5000 naval volunteers, would create an impression of our varied and abundant resources which might be the means of preserving peace, and would greatly strengthen the Navy in time of war.

In view of recent political changes, our policy for manning the Navy must be framed in conformity with democratic ideas. Large standing forces excite jealousy, while the instruction of the civil population in the use of arms is popular with the democracy. The permanent forces of the Navy should be brought to the highest standard of training; but we must rest content with moderate numbers. The permanent forces should be backed by a reserve which should have no rival elsewhere for strength and efficiency.

Turning to the Colonies which have no Europeans available for manning the fleet, we may follow Captain Johnstone's well-considered estimate of their capabilities. India can provide lascars for coast and harbour defence, and for despatch vessels. Hong Kong can supply a useful contingent of Chinese, who would be capable of supplementing the European force in British men-of-war. The Chinese already supply a considerable number of servants, stokers, and tradesmen to the ships in commission on the China station. Ceylon can supply stokers in limited numbers. The Straits Settlements possess a large seafaring population of Malays.

Commercial harbours.

The responsibility rests with the War Department, but the defence of the commercial ports is so essential to the strength of the Navy that it cannot be passed over altogether in silence. To those great places of trade which it is admitted we cannot afford to neglect should be added Holyhead, as an outpost for the Mersey, and commanding the Irish Channel. The construction of a fortified harbour at Filey, or in Hartlepool Bay, is essential to the defence of the Tyne, the Tees, and the Humber. In addition to the fortifications and submarine mines, armoured defence ships, gunboats, and torpedo boats are necessary, and the Admiralty is now in a position to supply them.

Manning of coast defence flotilla.

The manning of the flotilla can be undertaken by the second class Naval Reserve and the Royal Naval Artillery Volunteers, led by a few men from the fleet, and commanded by trained officers. A scheme for this service should be carefully prepared, and it is scarcely reasonable that this important duty should be added to the work already undertaken by the Admiral Superintendent of the Reserves. The task will properly devolve on the officer appointed to assist the Admiral.

Military defence.

The organisation of the military defence of our seaports leaves much to be desired. The weak points brought out in the experimental operations at Milford Haven were described at the Royal United Service Institution in a lecture by Colonel Schaw, the Deputy-Director of Works for Fortifications.

The War Office have lately given considerable attention to the torpedo defences of the coast, and submarine mines, moorings, and apparatus, and boats have been distributed to the several harbours and rivers, notably to the Tyne. These efforts should not be relaxed until we have made ourselves thoroughly secure from attack.

CHAPTER V.

EDUCATION AND TRAINING OF NAVAL OFFICERS.

Committee on naval education.

IN connection with naval education, the completion of their able report by the committee, who have done such good service in conducting an enquiry into the subject, is the notable incident of the year.

Age of entry.

The advancement of the age of entry for cadets to sixteen is perhaps the most important recommendation put forward by the committee. The Admiralty have been reluctant to make concessions to the new necessities of naval education. Naval opinion, generally, is in favour of the early entry of cadets as an indispensable means of hardening lads to the unnatural conditions of life at sea. We may hesitate to condemn a system supported by long traditions, and which, in the case of officers who have risen to the distinguished position held by Lords of the Admiralty, must be admitted to have been successful. The necessity for a broader foundation than heretofore for the education of a naval officer is, however, indisputable, and instances are not wanting of conspicuous ability for the sea service in the case of officers who began their career afloat at an advanced age. Blake set his foot for the first time on the deck of a ship of war at the age of fifty.

New regulations as to age.

The age of entry under the revised regulations will be advanced in 1888 to fourteen and a half. The Admiralty might with advantage have raised it to fifteen years. Allowing two years in the Britannia, the education of cadets at the age of seventeen might have been brought up to the standard insisted upon by the committee in the plan they propose of entering at sixteen, to remain one year only in the Britannia.

Naval education in France.

In the French Navy the system of education has been more favourable than our own to the acquisition of scientific knowledge. The cadets on board the Borda begin far in advance of where the cadets in the Britannia finish, and the finish of the course in the Borda is on the whole far in advance of the course the sub-lieutenants are required to go through at the Royal Naval College at Greenwich. The advantage of the French system over the English system lies in the instruction being continuous from first to last. There is no break in the education of the French naval officer in scientific subjects from the time he enters the *Lycée* as a boy to his becoming a first-class midshipman at the age of nineteen.

Training on leaving Britannia.

On passing out of the Britannia every midshipman should be sent to the flying squadron under special arrangements for his professional training. This will be far better for the young officers of the Navy than sending them to corvettes on trying stations, such as the East Indies, or the West Indies, where there is much risk of failure of health at an early age, and where the exigencies of the public service may require that the ships should be detained for long periods in rivers and harbours, where little can be gained in professional knowledge and experience. In the flagships on foreign stations it may often be the case that the time spent at sea is too limited for the training of young officers. It is reported in the service journals that the present Board have wisely decided to withdraw midshipmen to a large extent from the foreign squadrons, and to give them that far more useful experience which will be acquired by service in the flying squadron.

Training in pilotage.

Having completed his service afloat as a midshipman in the flying squadron, and gone through the course at Greenwich, every officer should pass through the vessel or vessels, which should certainly be commissioned for the purposes of training the Navy in practical pilotage. The losses of her Majesty's ships, and the sacrifices of valuable lives, which from time to time occur through inexperience in pilotage, and in the handling of ships, especially at night, and in crowded waters, are not only lamentable in their immediate consequences, but bring some discredit to the service generally. In small vessels the charge of watches must necessarily be entrusted to young officers. Early in his career the naval officer should be trained in pilotage. The case of the Wasp, totally lost at Tory Island, from utter inexperience in judgment of distance at night, will be fresh in naval recollection. A case of a similar character, in the circumstance that the danger upon which the vessel struck was surrounded by deep water, and marked by a powerful light, has recently occurred. We quote from the *Army and Navy Gazette*:—

"Letters from Malta state that on April 22, Captain Drummond, of the Temeraire, presided over a Court convened to try Lieut.-Com. R. Y. Smith, and Lieut. H. H. Campbell, both of the Starling, for stranding that vessel on the Dædalus reef, on January 7 last (1887). The

Dædalus reef is in the fairway of the Red Sea, about 180 miles south of Shadwan Island. It is of coral formation surrounded by very deep water, and on it is a lighthouse, showing a light visible fourteen miles. According to the evidence, the Starling was proceeding to the southward at the rate of six miles an hour, to sight the Dædalus light in order to fix her exact position before standing over to the coast. The light was sighted on the port bow about 10.15 p.m., and the course altered directly for it, the lieutenant-commander giving orders to the officer of the watch to let him know when it was distant three miles. About ten minutes after midnight, the lieutenant-commander was informed by the officer of the watch that the light was about three miles off, and he then came on deck and took charge himself. The course of the ship was not altered up to the time she struck, which was about 12.45. Every effort was made to get the ship off by laying out anchors, transporting weights aft, rolling her, &c., but to no purpose, and a steamer heaving in sight, she was signalled to for assistance, and after some delay, owing to the hawsers carrying away, the Starling was towed off uninjured, except for the loss of a few sheets of copper. She made no water, and has been employed on various service ever since. The lieutenant-commander now took all the blame on himself, he being on deck, and in charge of the navigation when the ship struck. The court lasted more than six hours, and the sentence was that Lieut.-Com. Smith be dismissed his ship, and Lieut. Campbell the navigating officer be severely reprimanded."

The gunboats attached to the Reserve Squadron should be utilised for the instruction of young officers in pilotage. If the gunboats are not available, vessels should be specially commissioned. The French maintain a vessel specially as a school of pilotage.

Naval manœuvres.

The present Board have most wisely followed up the plan initiated by their predecessors, and which is adopted by the French, Russian, Austrian, Italian, and German navies, of bringing together every year in the favourable season the most powerful force available for practical exercise in the various operations of naval war. The training of officers and men is an element of naval strength not less than the building of ships. Superior skill on the part of commanders will make itself felt in war in a degree but imperfectly appreciated by those who measure the fighting efficiency of navies by the incomplete and sometimes illusory test of thickness of armour, and the calibre of guns. A French writer well remarks: "Lissa montrait ce que pouvaient des vaisseaux en bois conduits par un homme de fer contre des vaisseaux en fer conduits par un homme de bois."

In the manœuvres of the powerful fleets which we should assemble every summer, the quick eye and the stout nerve required to handle ships boldly in action will be best obtained. Such qualities can only be gained by practice; and to every officer his opportunity should be given under proper supervision. What follows is from the pen of that accomplished master in the art of handling ships, Sir Geoffrey Hornby:—"Some officers believe that ships can be well handled in a squadron if their relative turning power, and the speed corresponding with the revolutions of their engines are known; that is not my experience. I have never seen a squadron well handled except by men whose eyes had become accustomed to their work. Young officers should not think that practice in a steam-launch or gunboat will enable them to handle an ironclad. The handling of these smaller vessels is good exercise; but no amount of theory will enable them to handle ships and boats. Practice, which gives the well-trained eye, will enable them to do any of the pretty things they see done by the best officers, pilots, and yacht skippers." For the manœuvres great care should be used in the selections for commands. These invaluable opportunities of gaining experience should be utilised for the benefit of officers upon whom the Admiralty would rely to command large fleets.

Special lines in the Naval profession

The training of the Navy would give more uniformly satisfactory results if officers were allowed more chance than at present of taking up a special line in the service. It is not reasonable to expect in the same man an equal aptitude for all the branches of the naval profession. After a few years of active service men will discover what it is they are best fitted to do, and they should be encouraged and assisted by appropriate appointments to attain perfection in that line in the profession which they desire to follow. The captains must be few who will to-day command a full-rigged frigate, and to-morrow a mastless turret ship, with equal success. An officer who has given his understanding to gunnery and the torpedo may not exhibit consummate skill in pilotage on dark nights or in foggy weather. M. Gougeard has some admirable observations on this topic. We quote from *La Marine de Guerre*:—

M. Gougeard on special lines of training.

"Vouloir faire d'un capitaine de vaisseau successivement un directeur d'artillerie, un commandant à la mer ou un directeur des constructions navales, c'est là évidemment une entreprise insensée. Attirer dans la marine, par la perspective des carrières diverses, une jeunesse d'élite; lui assurer dans les mêmes écoles les bienfaits d'une instruction solide, variée, mais en même temps dirigée vers les choses de la mer: lui donner ensuite, dans les premières années de sa vie, cette trempe vigoureuse qu'on acquiert au milieu des dangers et des fatigues de la navigation; puis, lorsque les aptitudes se sont révélées, donner à chacun la direction spéciale qu'il ne devra plus quitter jusqu'à la fin de sa carrière, telle est, selon nous, la vérité en matière d'organisation maritime."

Objections to half-pay.

Turning to the training of the Navy in the senior ranks, the present practice of keeping officers for long periods on half-pay is much to be deprecated. As a means of avoiding this great evil, it is suggested that a suitable vessel should be attached to the fleet during the annual manœuvres, and that selected officers should form a committee for the purpose of taking careful note of the proceedings. Confidential reports should be prepared by the committee, not in the nature of criticisms, but of suggestions with reference to the tactics to be adopted in naval battles with the modern weapons. The Intelligence Branch should be associated with the special committee in the preparation of these reports.

Torpedo boat training school.

The introduction of the torpedo, the torpedo boat, and the torpedo boat-catcher, calls for the creation of a special service for the efficient manning of the coast defence flotilla. A school of training for this purpose is not less necessary than a school of gunnery. Sheerness seems a suitable port for the headquarters of such an establishment. The channels in the estuary of the Thames are well adapted to the work to be done. It was in these waters that Lord Nelson, as he tells us in his autobiography, acquired, when in the command of the longboat belonging to the flagship at the Nore, that confidence in navigating among shoals and dangers, which was signally displayed in the battles of the Nile and Copenhagen.

Winter cruises.

The winter cruises of the Training Squadron and Channel Fleet are not less essential than the great manœuvres of the summer months. Referring to the unprecedented reduction of the French Mediterranean fleet during the present winter to four ironclads, a step taken in deference to financial exigencies, it is justly remarked by M. Weyl: "To manœuvre squadrons in the basin of the Mediterranean, or in the North Sea, during the fine season, when the days are long and the weather calm, is better than leaving ships altogether in port; but in navigation under these conditions, a factor of enormous importance is eliminated: strong winds and heavy seas are rarely encountered. It is only in bad weather that sailors are made, and are able to show all the qualities that they should possess. It is by continual struggle with the elements that moral as well as physical qualities are developed. For this reason it is much to be regretted that the manœuvres of our squadron should be suspended during the winter."

Fertility of resource.

It is a valuable qualification in a sea officer to be able to keep his ship efficient without appealing to a dockyard for assistance. In peace the necessity for this independence of action is less felt. It is of vital consequence in war to execute repairs without taking a ship from her station. In his correspondence with Earl St. Vincent, Lord Nelson refers frequently to this most practical question: "You taught us," he writes to Lord St. Vincent, "to keep the seamen healthy without going into port, and to stay at sea for years without a refit. We know not the meaning of the word." And again: "I find such a deficiency of resources that even I, who never had any compared with twenty who served in the Mediterranean, am astonished; but by seeing how others get on in the service it is surprising what example effects." The recent orders issued by the Admiralty prohibiting ships from coming upon the dockyards for minor repairs is a step in the right direction.

Knowledge of languages.

The Admiralty have not done enough to encourage a knowledge of languages. In a Service newspaper attention has recently been directed to the liberal rewards paid to officers of the Army who have passed in Russian and Arabic. The same journal remarks that "there are at present eighty-seven interpreters in various languages, European and Oriental, on the active list of the Navy, and of these only two are paid as such." Gifted linguists are to be found in the service, but modern languages have not been sufficiently cultivated in the British Navy. Throughout his career, and especially when he attains to sufficient rank to hold more responsible commands, in which he may frequently be called upon to hold diplomatic relations with foreign powers, a knowledge of languages is an indispensable attainment for a naval officer.

Course at Greenwich.

The course of education at the Naval College at Greenwich demands careful consideration, not by professors of mathematics, but by the superior officers of the Navy, who know the practical requirements of the service. It is difficult to repress a doubt as to whether the curriculum in high mathematics may not be insisted upon too rigorously, resulting, in the case of many officers who have no taste for it, in a slender knowledge of the subject upon which their efforts have been unduly concentrated, and absolute ignorance in other matters which would have been of equal value in a naval career. In certain branches pure science is necessary, and we want a large number of scientific officers; but in the average officer practical navigation and pilotage, practical gunnery, nerve in handling ships, tact in dealing with men, and general culture, including the ability to write a good and clear report, are the qualifications required.

Mr. Croker. Advice to naval officers.

Excellent advice was given on this point by Mr. Croker, in a letter to a young officer:—

"At the beginning, we consider that much punishment is a proof that he does not understand the true discipline of the service.

"Moderation to your men, good humour with your officers, and a command over yourself, are the three essentials towards your being a respectable officer.

"Let me repeat to you that economy—that is, the living within one's income, whatever it may be—is the foundation of all true respectability.

"As to writing, I beg of you to take pains with your hand, and learn to write like a gentleman; nothing gives a more unfavourable impression than an ill-written, ill-spelled, ill-folded, ill-sealed letter."

It is the ungrateful task of the critic to insist on deficiencies. It is an agreeable duty to conclude with words of well-merited praise. In spite of difficulties and disadvantages, the naval officer is an universal favourite. Few writers are more competent, by knowledge of the world and personal association with the Navy, than Baron Hübner. He has given us the impressions of many voyages:—

Naval life. Hübner, i. 41.

"Les labeurs, les soucis, les émotions de la mer. . . J'aime la camaraderie du marin, cette franche intimité entre chefs et officiers doucement contenue par l'usage du monde et les traditions de la discipline."

Education of engineers. R.N.

The education and training of the engineers of the Royal Navy has become a question of the utmost importance. It is conducted under existing arrangements in a college at Devonport, and on board the Marlborough at Portsmouth. The cost of the instruction is given in the estimates at £13,303 a year. The training of the engineer students has left much to be desired, at least in relation to the purely scholastic attainments. Until within quite a recent period, the results of the periodical examinations were not satisfactory. As a remedy, it was proposed by the former director of studies, Dr. Hirst, and by his successor, Mr. Niven, that the engineering students should be taken from the dockyard schools, and placed under the charge of a highly-qualified master of University standing. The last estimates make provision at Portsmouth for a head master of University standing, and assistant masters well qualified for their duties. The reorganisation of the educational arrangements is a timely recognition of the necessity for imparting a more thorough mathematical and scientific training to the engineer students. It would appear that no changes are in contemplation at Devonport. The students will complete their practical education at the principal dockyard.

It is the general feeling among the engineer officers of the Navy that the subscriptions to be paid by the parents of the candidates should be largely increased, so as to put the major part of the cost of educating and training the officers upon the parents, reductions being made in the case of the sons of deceased naval and military officers, and deceased colonial political officers of distinguished service. The training of engineer students is estimated at £54 per year. When the fees are raised so as to cover the cost of education, access to the profession of a naval engineer should be kept open to the sons of the employés in the dockyards by a liberal provision of scholarships, giving the privileges of a free education in the engineering colleges.

Growing importance of engine-room artificers.

The artificers of the Navy are gradually gaining the confidence of the Service, and are being charged with higher responsibilities. The training of the artificers of the Navy should be similar to that of an engineer in the merchant service. It will be practical rather than mathematical. The engine-room artificers will perform all the duties which should fall on watch-keeping officers, and their emoluments will be considered in relation to their duties. As these changes develop themselves, the sphere of the present engineers R.N. will be limited to the general supervision of their department. Their numbers will be reduced, and one of the colleges for engineer students may be closed.

CHAPTER VI.

COALING STATIONS AND GRAVING DOCKS ABROAD.

O quid agis? fortiter occupa Portum!

Enumeration of British coaling stations.

THE coaling stations, on which we depend for our communication with the East by the Suez Canal, are Gibraltar, Malta, Aden, Ceylon, Singapore, and Hong Kong. The coaling stations on the line of the alternative route by the Cape are Sierra Leone, St. Helena, Cape Town, and Mauritius. On the route to the Australian Colonies, King George's Sound is of vital importance. On the north coast of Australia Thursday Island is in a commanding position on the best route for steamers from Australia to India and China, and on the shortest line between Queensland and England. On the completion of the Panama Canal we should require a base at Jamaica or St. Lucia, whence our cruisers, detached for the protection of trade in those seas, might draw their supplies of fuel.

Delay in undertaking defences.

We have a conspicuous advantage over other maritime powers in the possession of a connected chain of coaling stations along the main line of our ocean steam trade. We have too long neglected the obvious duty of making our valuable depots secure from attack. The blame must be divided between political parties of all shades of opinion. Successive ministers have shrunk from the unpopular task of proposing expenditure for an object, the necessity of which had not been put before the public in a manner to command attention. Under our popular system of government it must be accepted that it is a vain thing for officers and experts to address memoranda and despatches to the eminent statesmen who in turn preside as the political heads over the naval and military services. Politicians are helpless unless backed by public opinion. To all proposals to spend money for any object, the necessity of which has not been established in the public mind, the Treasury, as the guardian of the public purse, is certain to turn a deaf ear. The first step to be taken is to address ourselves to "the man in the street." Happily in England he is generally a man of public spirit and intelligence, but wanting probably in information on subjects which lie remote from the particular sphere in life in which he moves. If we can convince the public that our proposal is sound, there will be no difficulty through official resistance. To do what the newspapers did for the Navy, or, in the telling phrase of Mr. Forwood, to "keep pegging away," is the only means by which the attention of a nation immersed in business can be arrested.

The country has at last been roused from a condition of apathy in respect to the defences of the coaling stations. That apathy was due entirely to want of information. For good reasons the report of the evidence taken by the Royal Commission on the defence of British possessions and commerce abroad was treated as a confidential document. As their report did not find its way into the hands of the public, there was no demand for action on the part of the Government, and but for the influence of the press the recommendation of the Commission would have been pigeon-holed.

Hesitation to approve expenditure explained.

If the public is somewhat slow to be moved, especially in the matter of fortifications, the explanation is not far to seek. Many a costly proposal has been pressed, and many have been carried into execution, for which, as experience has shown, there was no real justification. We have an instance in point in the case of Alderney. And are we quite clear that the great works at Dover were a necessity? Was it policy to defend Bermuda with works, which could not be manned with less than 7000 men, the strength of the garrison in time of peace being 1400, with slender probability of reinforcement in the event of war? Bermuda would become a naval base of the first importance only in the event of a conflict with the United States, and such a contingency is altogether beyond the range of practical politics.

Fortifications the best defence of harbours.

While the assent to proposals to fortify particular positions must not be expected without long and patient argument and conclusive proof, there will be little difficulty in demonstrating to the taxpayer this general and indisputable proposition, that, wherever we have a position of unquestioned importance to defend, protection will be most effectively and economically given by fortifications. To keep our ships in port for harbour defence is not only a most expensive method, but a diversion of the Navy from its proper duty. The sphere of action of the Navy has been defined with the voice of authority by the Royal Commission on the Defence of the Coaling Stations. It is "To blockade the ports of an enemy, destroy his trade, attack his possessions, deal with his ships at sea, and prevent an attack in great force upon any special place."

Sir Anthony Hoskins.

The proper relation of the naval to the military defences of the empire has been defined by Sir Anthony Hoskins:—"The principal duty of the commander of a naval force is to meet a hostile squadron wherever it can be found, and not by dividing his ships in the different ports, to give the enemy the command of the sea and the power of attacking him separately. He has a right to expect that the principal ports shall be protected by land forces and batteries either afloat or on shore, sufficiently strong to protect them against an ordinary cruising squadron, and by sending it off to give him a better chance of intercepting it."

Illustration of waste of resource in using ships for harbour defence.

As an illustration in support of the considerations which have been urged, reference may be made to the means recently adopted for the defence of King George's Sound when a war with Russia appeared imminent. The present writer was informed, on the occasion of a recent visit to that important harbour, that a corvette and a sloop were detained some weeks at King George's Sound for its defence. The united crews can scarcely have numbered less than 400 men. It is no exaggeration to say that forty men in a battery would have given equal security against attack by a cruiser attempting a rush for the port to fill up empty bunkers.

Cost of works and armaments.

The delay in undertaking and completing the works and armaments for the defences of the coaling stations is the more regrettable, having regard to the moderate amount of the aggregate charge, and to the fact that it anticipates and provides for all requirements of defence for many years.

The Imperial expenditure on the scheme now in progress is for—

Works	£185,250
Armaments	671,830

During a recent cruise, the Sunbeam visited all the coaling stations on the route to the East and Australia, except Hong Kong. I proceed to give the impressions and information gathered on the spot. No allusion need be made to Gibraltar, Malta, and Aden. These positions have not been neglected, and it must be presumed that they are practically impregnable.

Bombay.

At Bombay the reconstruction of forts is being pushed forward, and armaments of heavy guns of modern date, though not of the latest patterns, are available. For the afloat defence an additional turret ship, Magdala type improved, and more torpedo boats, are required. With these additions the *matériel* of defence will be complete. The *personnel* is more difficult. Under present conditions the European volunteers must be relied upon to man the guns in the

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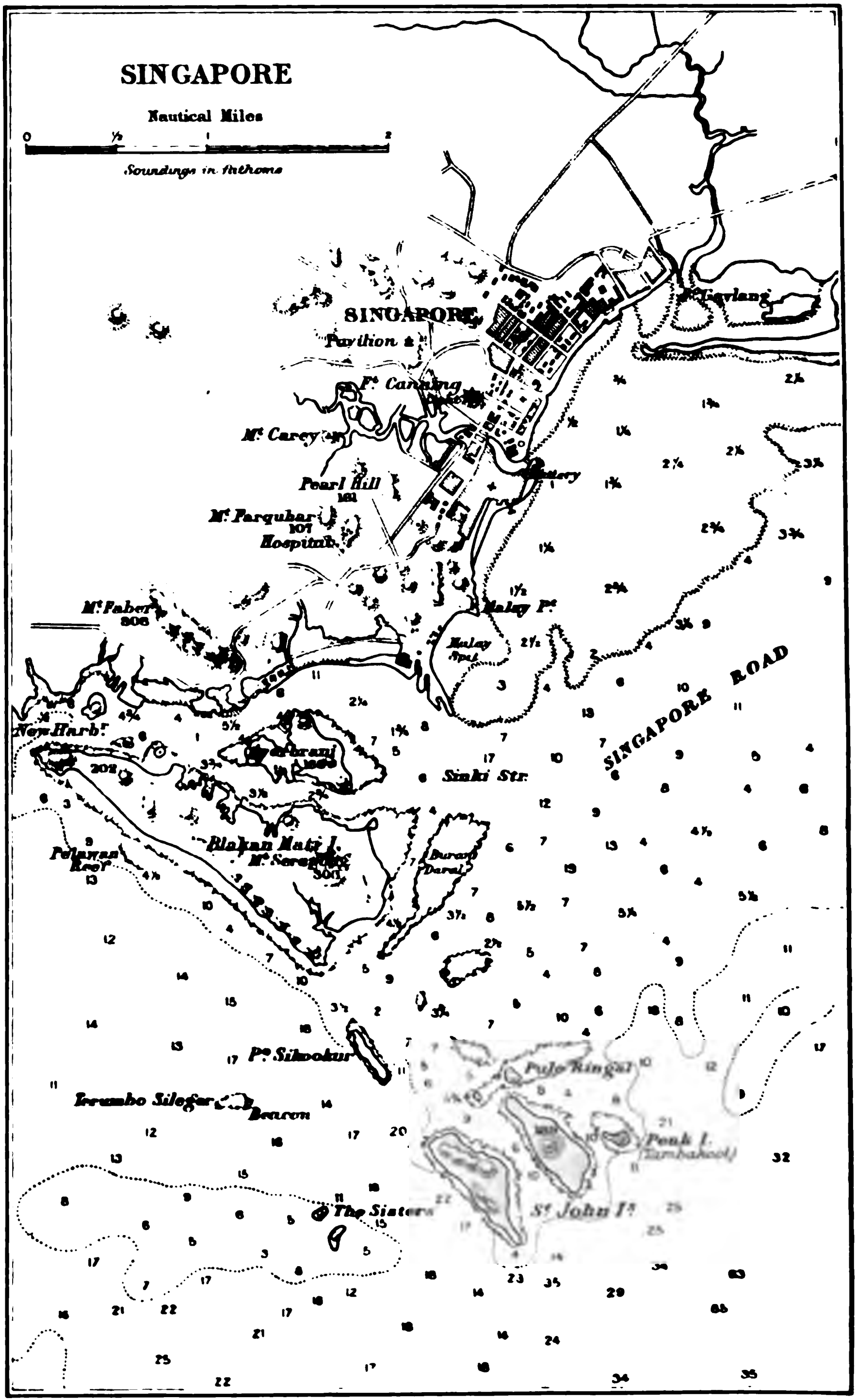


Stanford's Geog. Estab^t

forts. The flagship on the station, which is not a suitable vessel for war service, could turn over a portion of her numerous crew to the armoured turret ships and torpedo flotilla.

Ceylon, Trincomalee.

Trincomalee has a magnificent harbour, the finest in the East, but unfortunately of no value for the purposes of commerce. The surrounding country is a dense and inhospitable jungle. Colombo is more happily situated, and here the trade of Ceylon is carried on with perfect security and convenience. Colombo should have been taken in hand, and its defences completed, before attention was diverted elsewhere. A more ambitious policy has been adopted, and new works are in progress both at Trincomalee and Colombo. No delay need be anticipated in the completion of the works. The Imperial Government have undertaken the armament, and guns will no doubt be provided, probably months, and perhaps years, behind time.

Colombo.

For the manning of the works a mixed force of British regulars, European volunteers, and Sikhs or Goorkhas should be organised.

Singapore.

Singapore, as the key of the China, Java, and Indian seas, is a coaling station of the first class. It is described in the final report of the Commission on Coaling Stations as "not only a port of call, but a great commercial centre. Extensive wharves, with three docks capable of accommodating merchant vessels of the largest class, and appliances for effecting the heaviest repairs, have been provided. They are frequently used by Dutch ships of war, and are, of course, available for ships of the Royal Navy. The average quantity of coal in the port in 1876 was 93,000 tons, when the number of steamers calling yearly was about 1000; but this number having now risen to 1700, from 12,000 to 15,000 tons are required each month." In 1881–2 the trade, passing through the Straits of Malacca, between Great Britain and the Far East, was estimated at £74,000,000. It is growing with rapid strides. Since the Russian scare the works necessary for the defence of Singapore have been completed at the expense of the local Government. The forts are of the most approved plans and of considerable extent. It is disappointing to an Englishman to see in this, as in other instances, that while those preparations for defence, for which Colonial funds are liable, are completed or far advanced, the guns for which the Imperial Government are responsible are not yet delivered.

For manning the forts, and to resist an enemy attempting a landing, the local Government of Singapore have at their disposal considerable forces. In addition to a wing of a British regiment, they have a splendid battalion of 1000 Sikh police, armed and drilled as soldiers. By the care and energy of Sir Frederick Weld and Sir Hudson Low, a numerous and effective auxiliary force has been organised at Perak, with an efficient field artillery. Some hundreds of men can be spared from Perak for the defence of Singapore. The armaments for the forts now completed once provided, Singapore may be considered secure against any European force which is likely to be directed against it.

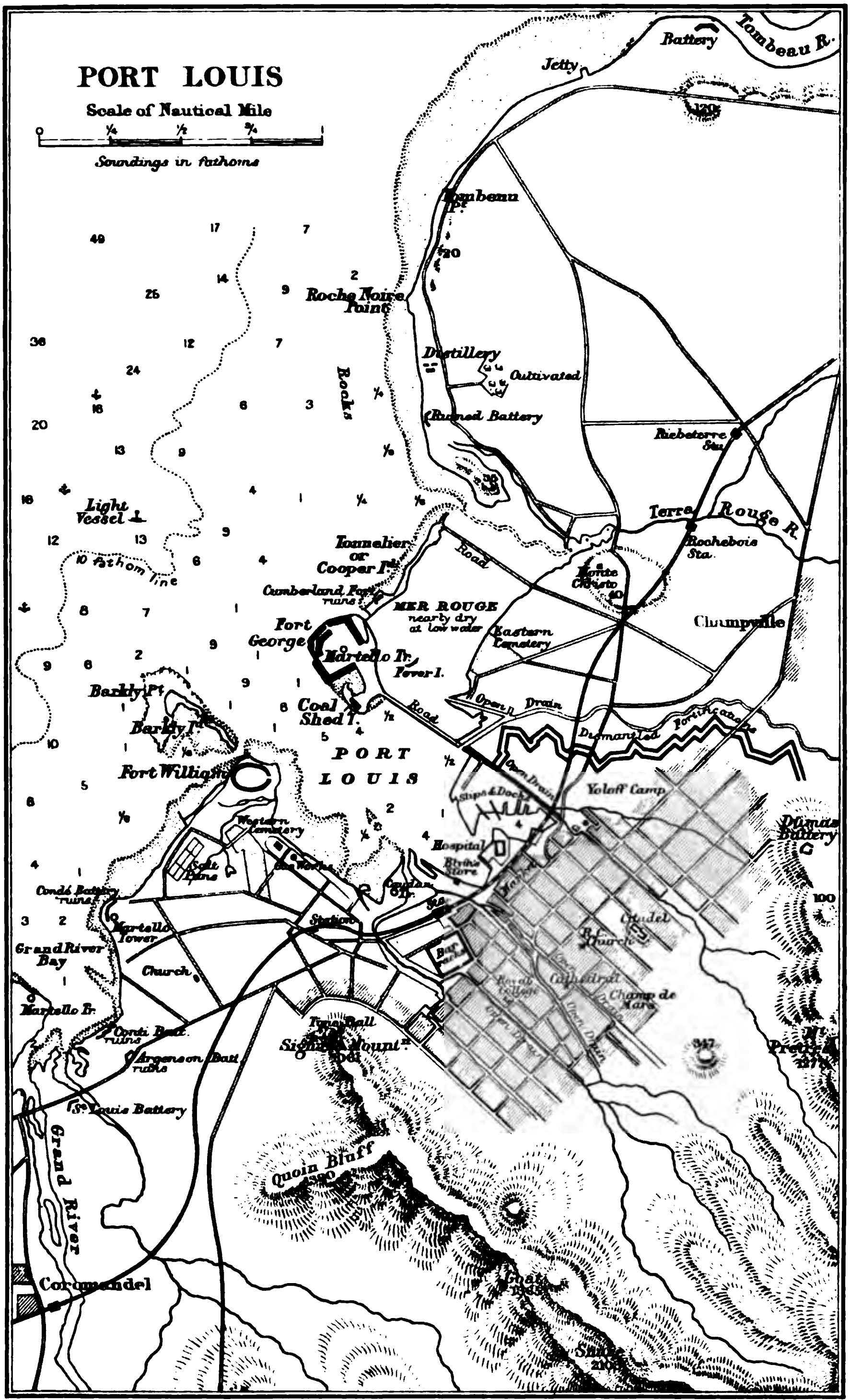
The defence has recently been materially strengthened by the stationing of the ironclad Orion in the Straits of Malacca.

From Singapore the Sunbeam proceeded to Australia, but the defences having been considered in a special section, we pass on to the several ports visited on the sad return voyage.

Mauritius. Mauritius is on the direct route and almost equidistant from the Cape and Ceylon. It has a trade of the annual value of six millions sterling. The harbour is deep, well sheltered, and capacious. Three graving docks have been constructed. One of these can be readily enlarged to receive a man-of-war of the Impérieuse type. The work would be taken in hand with the assistance of a loan of £50,000, on easy terms. A dock at Mauritius would be a most valuable resource in war, while in peace it would be a boon to the East India Squadron, if vessels could be sent to refit in one of the few harbours on the station which have a cool season.

The improvement of the existing forts at Port Louis and the formation of new defences have been commenced. The local Government contribute £55,000 for works, and the Imperial Government £55,750 for armaments. A torpedo and submarine defence has been provided. The manning of the works is an important question which still awaits solution. For the submarine mine and torpedo defence a native force is being enrolled, consisting of seafaring men led by thirteen non-commissioned officers of the Sappers and Miners. It is believed they will be thoroughly efficient. An artillery force of a similar character would probably be equally efficient for fighting guns.

It is highly desirable that Mauritius should be connected by cable with the line of telegraph recently laid to the Cape along the eastern shores of Africa. It was not satisfactory to see a fine steamer of the French Messageries Maritimes fleet lying at Mauritius, subsidised by the island Government, while no mail service exists under the British flag. It is certain that the French would not allow their island of Réunion to depend for its postal communications on a foreign service. At any cost a line of steamers would be maintained under the national flag.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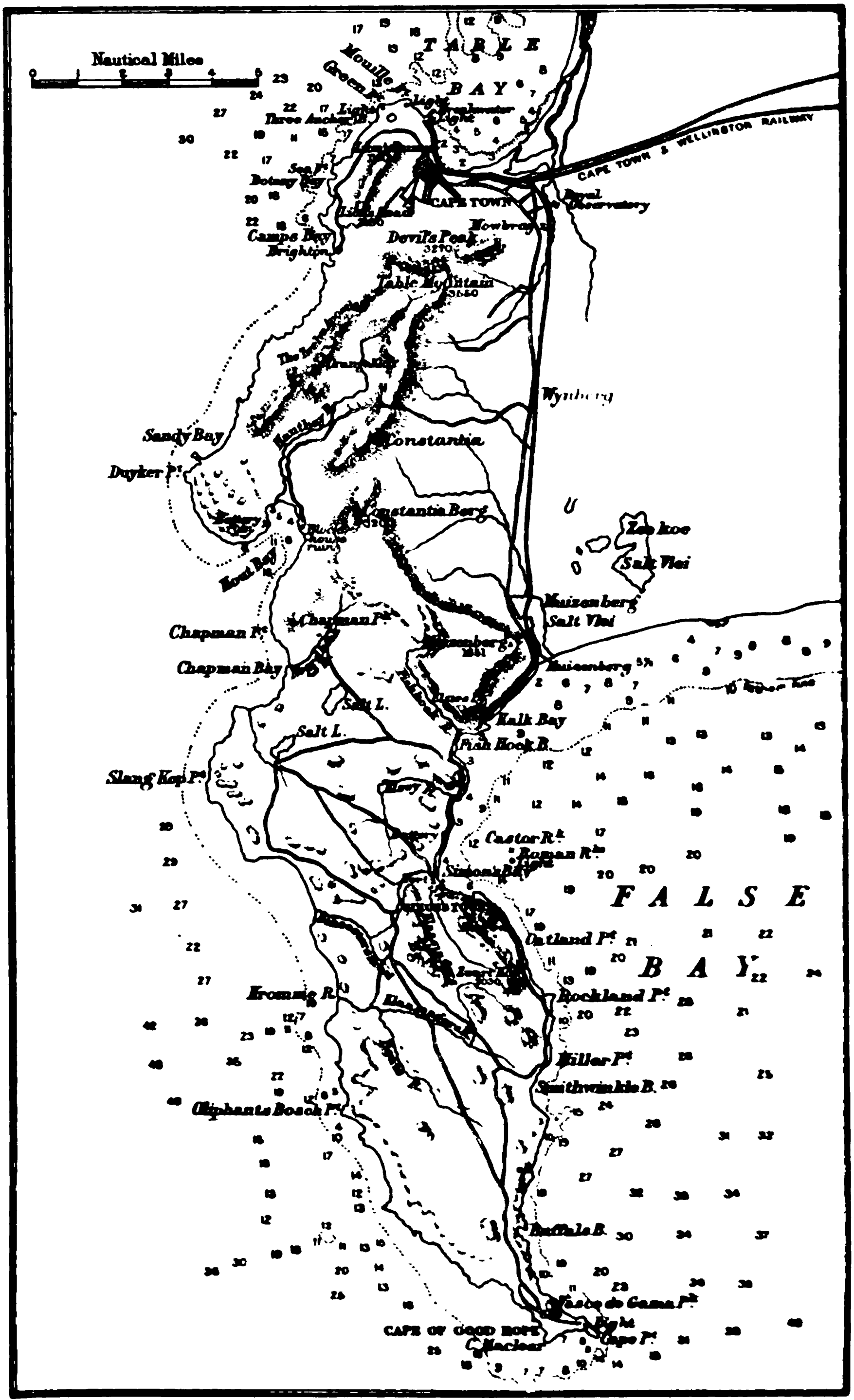
THE CAPE OF GOOD HOPE.



Stanford's Geog¹ Estab¹

The importance of the Cape as a strategical position is thoroughly understood in England. It is less generally known how favourable are the conditions for defence. The Colony owes its security to its iron-bound coast, and the mighty surges of the Southern Ocean. The Cape peninsula and Port Elizabeth afford anchorage for a fleet. Elsewhere a landing is impossible, except at a few coves, and only in boats of special construction, handled with practised skill.

Cape of Good Hope.

Confining our attention to the Cape peninsula, it was described by the Royal Commission as a rugged mountain district thirty-two miles in length, connected with the mainland by a low isthmus between Table Bay on the north and Simon's Bay on the south. The naval establishments are at Simon's Bay, the mercantile at Table Bay. The resources of Simon's Bay are equal to the light repairs of the fleet, and it is a suitable peace station. In war the squadron must operate from Table Bay, where we have at command a graving dock of ample dimensions for a powerful ironclad, large engineering shops, and unfailing supplies of coals. The extension of the breakwater renders the anchorage in Table Bay as secure as in Simon's Bay.

Cape peninsula.

Cape Town.

Before the construction of the breakwater, Table Bay was exposed to gales from N.W. to N.N.E., which occasionally blow with irresistible fury, and have in some instances caused the loss of every ship which happened to be at anchor within the Bay. The recurrence of the disasters of the past is no longer to be apprehended. A breakwater of solid construction has been formed under the direction of Sir John Coode. The staging is already carried out to a distance of 3050 feet. The entire length proposed is 3700 feet. The depth of water varies from five and a half to seven fathoms. An area, 18 acres in extent, is already protected from the most dangerous winds. On the completion of the breakwater the area protected will be 48 acres in extent. The docks already formed provide a roomy floating basin, and an additional basin, 15 acres in extent, is in progress. A graving dock has been recently completed, 500 feet in length, 70 feet in breadth, and with 26 feet of water over the sills.

Breakwater and docks.

It has been proposed to defend both Simon's Bay and Table Bay, charging the former upon the Imperial Exchequer, and the latter on local resources. The armaments in both cases are to be provided from Imperial funds. The works at Simon's Bay are well advanced. Nothing has yet been done by the local Government at Table Bay. It was discouraging to hear that the works at Simon's Bay, on which £50,000 is being expended, and upon which we saw five hundred men engaged, were to be armed with muzzle-loading

Simon's Bay defences.

Table Bay defences.

guns of short range. It is highly unsatisfactory to remodel works at considerable expense to mount an obsolete armament. A railway is essential to connect the batteries at Simon's Bay with the garrison at Cape Town. The Imperial Government should share with the local Government in the cost, which is estimated at £15,000.

Manning of defences.

In proof of the capabilities of the Colony to provide such garrisons as may be required to work the guns, whenever supplied by the Imperial Government, the following statement, made by Mr. Hofmeyer at the Colonial Conference, may be appropriately quoted:—

"In the case of the Cape we have a first line of defence, not a very strong line, a very thin line, consisting of 802 mounted riflemen, and 706 Cape mounted armed police. We have, secondly, of trained volunteers, 4000 men. Then we have a second line of defence, consisting of all the manhood of the country; all men between the ages of eighteen and fifty are enrolled in that force, and those amount to about 60,000 men. They are not regularly trained, but they are most of them armed, and they are men generally who can ride and shoot and do very effective service. They have been three or four times on active service in the last ten years, and they have generally given a good account of themselves. In addition to that we have Yeomanry Acts, which are not at present in operation. Under those Acts three or four regiments could be thoroughly and properly trained, but they are not trained at present."

Better political feeling.

The security of our possessions at the Cape is being rapidly strengthened by means more efficacious than those in the control of military engineers. The material prosperity of the Colony has become more assured. The diamond fields and the gold mines, it is hoped, will yield large profits. The trade and the revenue of the Colony show an immense improvement over the returns for many years past. An improvement of another kind is going forward, which will form a still deeper and more enduring foundation for our military power. The Cape Colony has so extended its territories, that the native races have been brought into a condition of permanent peace. We are establishing a better understanding with the Boers of the Transvaal. Within the limits of the Colony, unity of feeling and action on the part of the English-speaking and Dutch-speaking races is becoming more complete every day. During my recent visit I was assured by Mr. Hofmeyer, the leader of the Africander Bond, that the Dutch were entirely satisfied with British rule, and had no other desire than to remain in their present position, with uncontrolled self-government for their local affairs, and with the protection of England against all external enemies. They know full well that if the British flag were lowered in Table Bay, they would inevitably pass under the dominion of less generous rulers.

It is highly desirable that the British Government should acquire possession or control over Delagoa Bay.

St. Helena

Passing on to St. Helena, the landing-places are few, and commanded by works of considerable strength. New works are in progress which will give an extended range of fire to seaward. The guns are not yet to hand. The expenditure of £10,000 appears fully justified in view of the importance of St. Helena as a coaling station for the Cape route to the East. As a sanatorium, it might be of great value to the ships of the African squadron.

Ascension.

Barren and inhospitable, Ascension has presented a singularly unpromising field of labour to the naval detachment which for many years has been maintained in the island. Solid and capacious stores, extensive ranges of buildings, miles of roads, the tanks, the hospitals on the seashore and on the mountain, the farm on the peak—a green oasis crowning a heap of cinders—attest the zeal of a succession of officers and men. To the naval reformer they give occasion for reflections on the considerable cost which has been thrown upon the country in the creation of an establishment which has become practically useless through the universal use of steam and the suppression of the slave-trade. In the present circumstances, St. Helena offers unquestionably superior advantages for all naval purposes. As a coaling station it is in a better position, being approximately equidistant between the Cape and Sierra Leone, and less exposed to rollers, which frequently interrupt the coaling of ships at Ascension. It is repugnant to abandon to utter ruin an establishment created with much labour and expense. To this alternative, however, we must come, unless we are prepared to put Ascension in a state of defence. The value of the naval stores is not less than £50,000, and the ample stock of coal would offer an irresistible temptation to an enemy's cruiser. Three or four long-range, armour-piercing guns, with a few machine guns, would give security against a *coup de main.* We should look to the fleet to prevent an attack in force.

Sierra Leone.

Sierra Leone is an important coaling station, halfway between England and the Cape. The harbour is large and safe for ships of heavy tonnage. The works of defence are in active progress. The cost is estimated at £22,000 for works, and £15,000 for armaments. In addition to the works now in hand, a battery is thought desirable to prevent an attack with long-range guns from seaward. Having admitted Sierra Leone into the list of our coaling stations of the first class, its defence should be made complete against a powerful cruiser.

Graving docks.

In connection with the subject of coaling stations, it may be appropriate to refer to the deficiency of graving dock accommodation in several important positions.

Gibraltar.

To maintain a permanent garrison of 6000 men at Gibraltar, at an annual cost to the country under various heads of charge of nearly a million sterling, and to be obliged to send the solitary gunboat stationed in these waters to be docked at the Spanish dockyard at Caraccas, is not satisfactory. History repeats itself. The greatest battles of the past have been fought near the entrance to the Mediterranean, and the battles of the future may probably be fought in the same waters. The new weapon, the torpedo, will deal its blow below the water-line, and inflict injuries which can only be repaired in dock. It would be pitiful to see a British squadron in the Bay of Gibraltar, with ships in a crippled or sinking condition, and to find ourselves obliged to run them ashore on the Spanish beach. Our requirements at Gibraltar might be met, as at Hong Kong and the Cape, by co-operation between the Admiralty and private enterprise. There is reason to believe that with a moderate subsidy from the Government a graving dock would be constructed at Gibraltar. With the aid of a loan from the Government, a private company has recently completed a dock at Hong Kong, 500 feet in length, 86 in breadth, and 29 in depth.

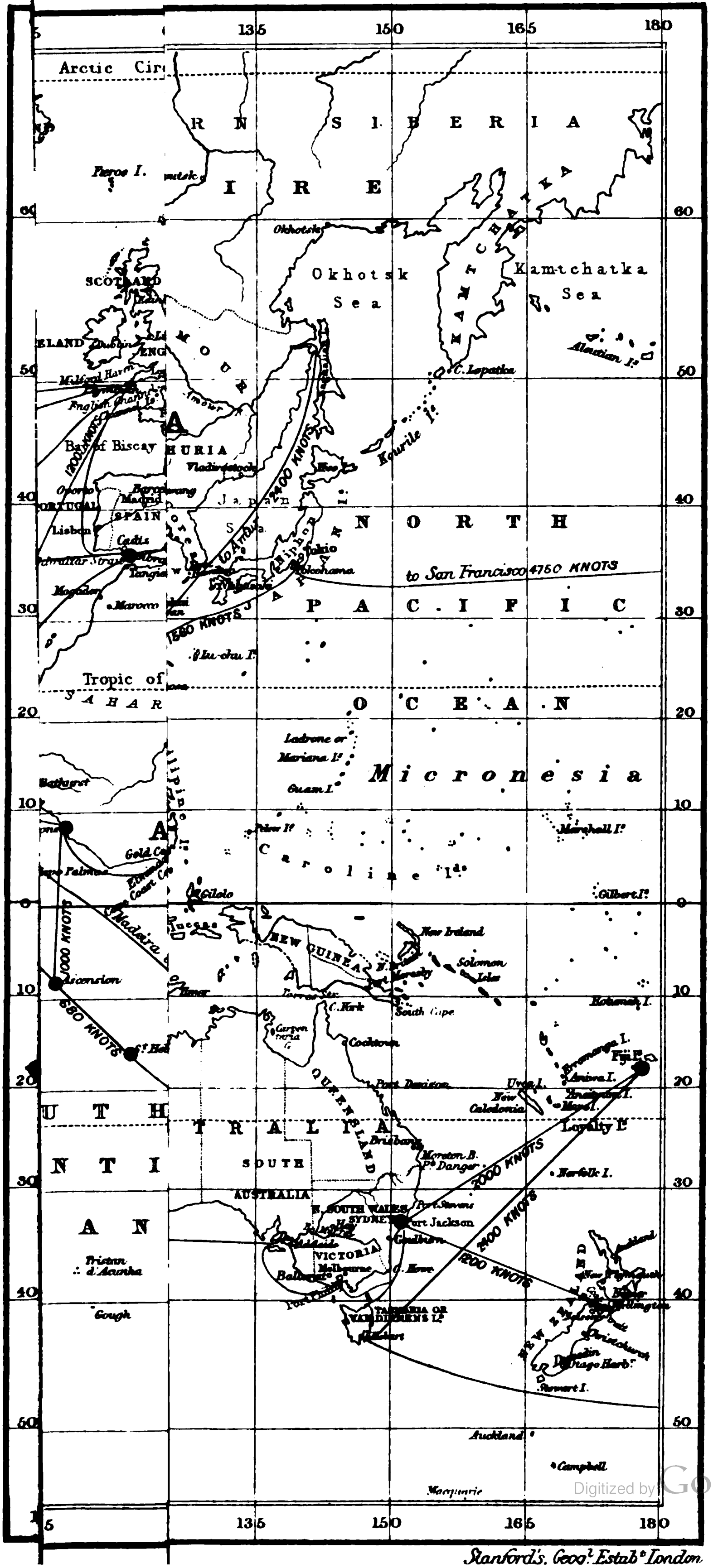
New dock at Hong Kong.

New graving dock at Esquimault.

By concerted action with the local authorities, and it could only have been accomplished by those means, a dock has been formed at Esquimault; length 380 feet, width of entrance 65 feet, depth over the sills 26 feet 6 inches. It is proposed, and it is highly desirable, to lengthen this dock to 430 feet. The Admiralty should obtain the sanction of the Treasury for a loan on easy terms.

As Civil Lord of the Admiralty, from the commencement of my term of office, I did my best to make good the deficiency in our dock accommodation abroad by the plan of co-operating with private enterprise. With less responsibility, but with equal solicitude for the efficiency of the Navy, I desire to bring our requirements at other places under the notice of those responsible for taking the necessary action.

An enlargement of one of the existing docks is much wanted at Singapore. If the Admiralty would assist, it would be quickly taken in hand.



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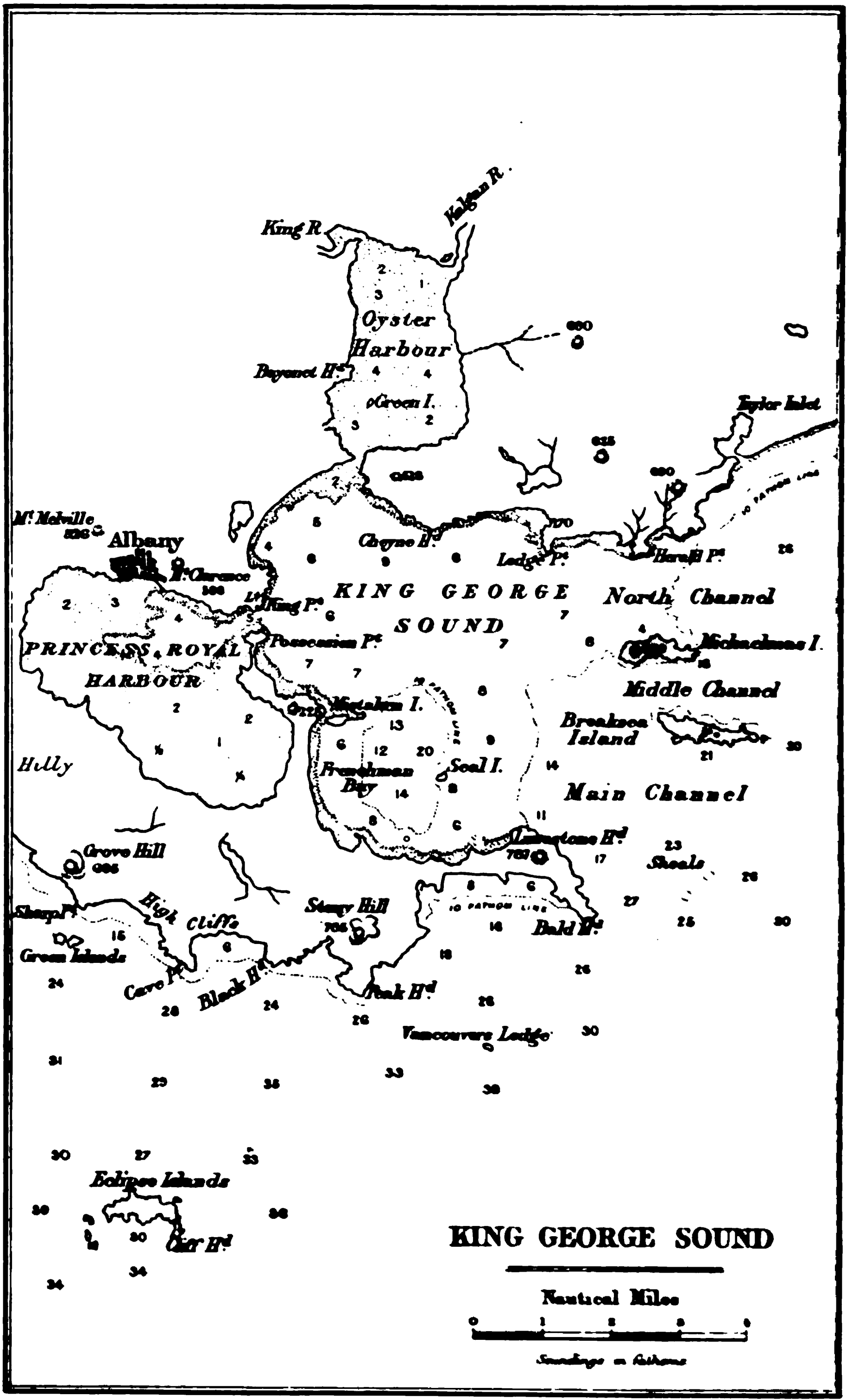


KING GEORGE SOUND

Nautical Miles

Soundings in fathoms

Stanford's Geog' Estab'

CHAPTER VII.

AUSTRALIAN DEFENCES AND NAVAL AND MILITARY PREPARATIONS.

It has been endeavoured to bring together in the present section the impressions formed during a recent voyage of circumnavigation round the coasts of Australia.

King George's Sound.

Taking the several ports and colonies in the order in which they were visited, the utterly defenceless state of King George's Sound is the first subject for consideration. All vessels cruising in Australian waters for the protection of the trade on the most direct route to England must depend on King George's Sound as a coaling station and a base of operations. The anchorage is commodious and secure. Port Darwin, the nearest harbour on the west side of Australia available for large vessels, is distant 2109 miles. On the south coast, the distance to Adelaide is more than a thousand miles. The nearest route from the principal ports of Australia to the Suez Canal passes within a few miles of the entrance to the harbour. The importance of the position is obvious. To quote from the report of Sir William Jervois, "King George's Sound, if left undefended, may in time of war be occupied by hostile vessels, which issuing from there might cut off our steamers and merchant ships. On the other hand, if defended it would become a most valuable naval port for vessels of war acting for defence."

Sir W. Jervois.

Alternative if not defended.

If no defences be provided, King George's Sound could be denied to an enemy by sinking the coal hulks in the narrow channel leading to the inner harbour. Such a method of defence would be a miserable alternative to be adopted by the empire which justly claims the supremacy of the seas, and which would stand in urgent need of the facilities afforded at King George's Sound for coaling her own cruisers.

Inexpensive works sufficient.

Protection against first-class ironclads is not needed. In time of war, ships such as the Peter the Great or the Amiral Duperré will be retained in European waters. The attack on our commerce in distant seas will be made by swift steamers, lightly armed, and probably unprotected by armour. We ought to be in a position to deny King George's Sound to vessels of this class, when short of coal. For this purpose inexpensive works with light armament would be adequate.

Distribution of cost.

To put the cost of these works wholly on Western Australia, the poorest of the colonies and the least interested in the protection of the great trade route between Australia and the mother country, would be unfair. The expense should be defrayed by the Imperial exchequer, and by a joint contribution from all the Australian colonies.

The Colonial Conference discussed the defence of King George's Sound, but was unable to come to a decision. The Colonies were unwilling to undertake the works, unless the Imperial Government would provide guns of modern construction. The cost was £19,000, a paltry sum to be refused by an exchequer which controls and provides for an expenditure of £90,000,000. Having invited the representatives of our Colonies to meet in London in much pomp and circumstance, it was impolitic to allow an important decision to be postponed upon a trifling issue.

Plan for manning the works.

The difficulty of manning has been sometimes urged as an argument against the construction of defensive works. Two feasible suggestions have been made for the defence of Albany. Captain Colomb, M.P., has suggested that the garrison should be supplied from the Marines and the Marine Artillery. The plan would obviate the necessity of sending a handful of soldiers on detached duty to Australia; and the Marines and Marine Artillery would take their turn of duty with their comrades in the Australian squadron. They need never be kept so long on shore as to become dispirited, or deteriorated by garrison duty in a remote spot. General Scratchley suggested another feasible plan of a volunteer militia, to consist of pensioners from the Imperial Army, who should receive pay and land grants.

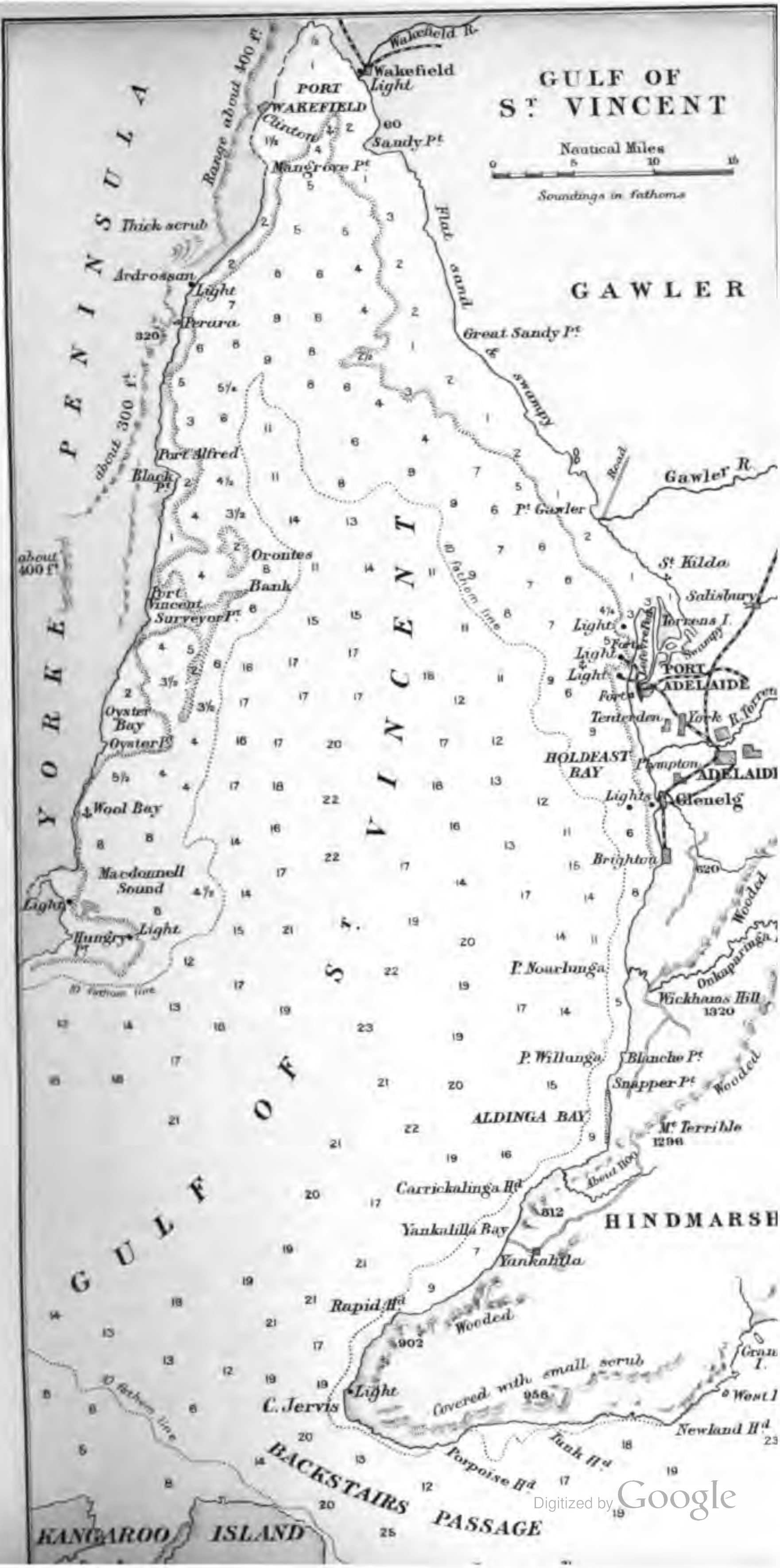
Adelaide.

Passing on from King George's Sound to the eastward, South Australia has one vessel for the protection of its coast. The colonial cruiser, The Protector, launched by Sir William Armstrong & Co. in 1884, is an efficient vessel of 900 tons, armed with one 8-inch, and five 6-inch breechloading guns. The speed on the measured mile was 14 knots. This vessel is commanded by Captain Walcott, R.N., and manned by a small permanent force. In the event of war she would operate in the Spencer and St. Vincent Gulfs, and guard the approaches to Adelaide.

Colonial cruiser Protector.

Land defences.

Adelaide is defended by two detached forts. Glanville is armed


GULF OF
S^T VINCENT
Nautical Miles
0
5
10
15
Soundings in fathoms
Wakefield R.
Wakefield
Light
PORT WAKEFIELD
Clinton
Sandy P^t
Mangrove P^t
Range about 400 f^t
YORKE PENINSULA
Thick scrub
Ardrossan
Light
Perara
320
Flat sand
GAWLER
Great Sandy P^t
& swamps
about 300 f^t
Port Alfred
Black P^t
Road
Gawler R.
P^t Gawler
about 400 f^t
Orontes Bank
Port Vincent
Surveyor P^t
10 fathom line
St Kilda
Salisbury
Light
Torrens I.
Fort
Light
Swampy
Light
PORT ADELAIDE
Fort
Tenterden
York
R. Torrens
Oyster Bay
Oyster P^t
HOLDFAST BAY
Plympton
ADELAIDE
Lights
Glenelg
Wool Bay
Brighton
620
Macdonnell Sound
Wooded
Light
Hungry P^t
Light
10 fathom line
P. Noarlunga
Onkaparinga
Wickhams Hill
1320
P. Willunga
Blanche P^t
Snapper P^t
Wooded
ALDINGA BAY
M^t Terrible
1296
About 1100
Carrickalinga H^d
812
HINDMARSH
Yankalilla Bay
Yankalilla
GULF OF ST. VINCENT
Rapid H^d
Wooded
902
Granite I.
Covered with small scrub
958
West I.
10 fathom line
Light
C. Jervis
Newland H^d
Porpoise H^d
Tunk H^d
BACKSTAIRS PASSAGE
KANGAROO ISLAND

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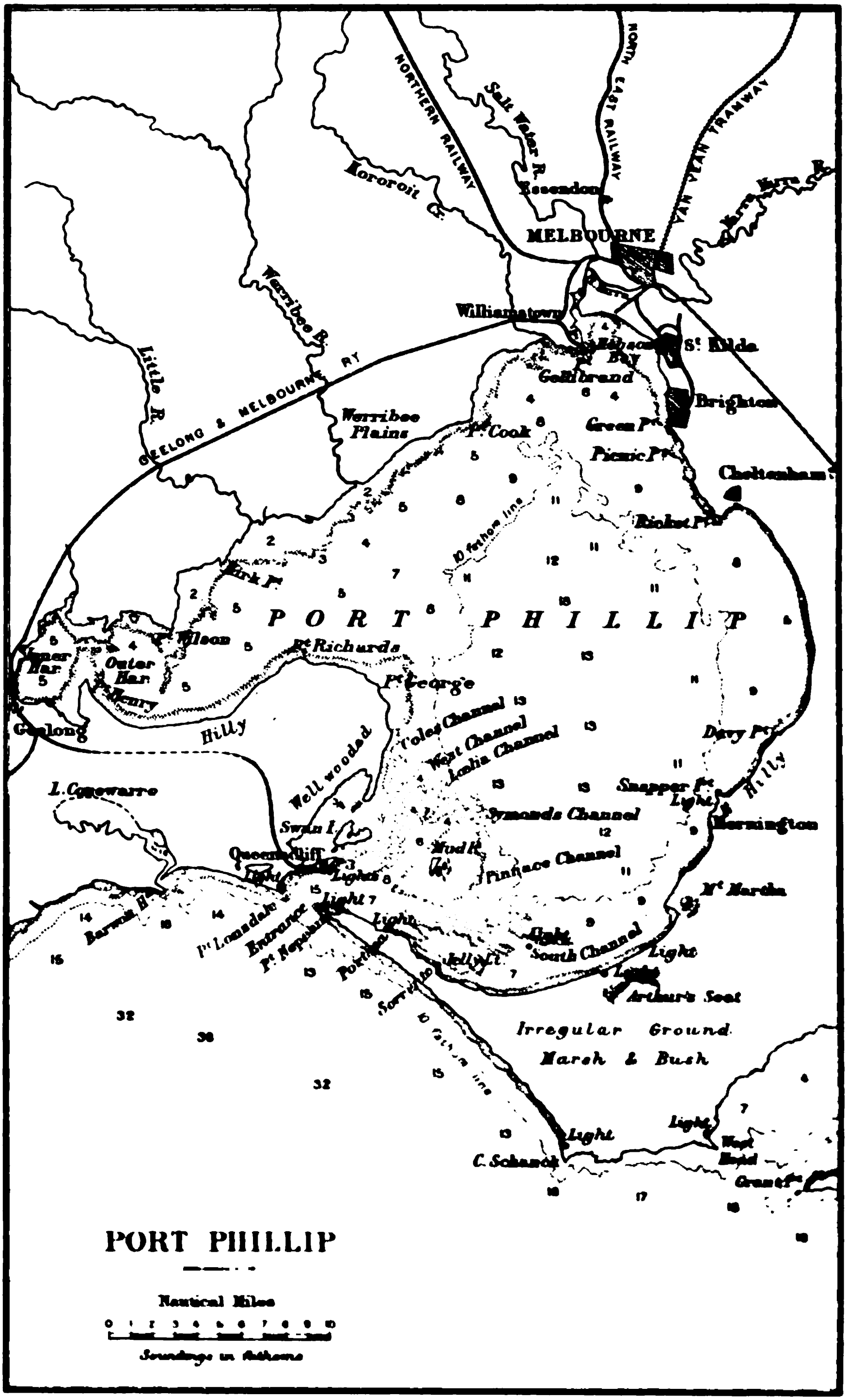


PORT PHILLIP

Nautical Miles

Soundings in fathoms

Stanford's Geog! Estab!

with two 20-ton 10-inch guns and two 64-pounders; Largs Fort is armed with two 12-ton 9-inch guns and two 80-pounders. A new fort is proposed to be built in the neighbourhood of Glenelg, to be armed with powerful breech-loading ordnance of the latest pattern.

Victoria.

Victoria has provided a powerful flotilla for the defence of the Colony.

The list of vessels is as follows:—

Cerberus, armour-plated double screw turret ship, 3480 tons displacement, 1370 H.P., four 10-inch 18-ton M.L. guns, four machine and two light guns. Permanent staff, 33 men.

Nelson, Frigate, 4096 tons displacement, 2102 H.P., two 7-inch M.L.R. guns, eighteen 64-pounder rifled shunt guns, twelve 32-pounder smooth-bore guns. The crew is partly furnished from the permanent staff.

N.B. Although used only as a receiving and drill ship, and not to be reckoned as a vessel of serious fighting power, a position has been assigned to the Nelson in the carefully considered plans for the defence of the harbour.

Gunboat Victoria, one 10-inch, 25-ton B.L. gun, two 13-pounder B.L. guns, two Nordenfelt machine guns, with permanent staff and 15 men.

Gunboat Albert, one 8-inch 12-ton B.L. gun, one 6-inch 4-ton B.L. gun, two 9-pounder B.L. guns, two Nordenfelt machine guns, with permanent staff and 13 men.

Childers, 1st class torpedo boat, for 15-inch torpedoes, two 1½-inch Hotchkiss guns; 7 permanent men.

Nepean . . Lonsdale . .	2nd class torpedo boats, for 14-inch torpedoes.
Commissioner Customs, No. 1	Steam launches armed with the spar torpedo.

Lady Loch, screw steamer, built of steel, 400 tons; armament one 6-inch 4-ton breech-loading gun and two Nordenfelts.

Arrangements have been made for arming six dock boats and harbour barges used by the Harbour Trust Board, with a 6-inch 4-ton gun, and two Nordenfelt guns.

Flotilla mainly for harbour defence.

The Childers and the two gunboats can alone be used outside the entrance to the fort. All the other vessels of the Victorian flotilla are for harbour defence, which, however, in its application to Melbourne, embraces a far wider sphere of operations than is usually implied. Port Phillip, the harbour of Melbourne, is an inland sea.

The entrance, distant between thirty and forty miles from the city, is commanded by fixed batteries, and mines are provided for closing the channels. The works are armed with one breech-loading 8-inch 12-ton gun, one 6-inch 5-ton gun, two breech-loading 6-inch 4-ton guns; six muzzle-loading 12-ton guns, and a considerable number of lighter guns. Considerable additions will probably be made to this armament at an early day. Fixed defences for Port Western are under consideration.

New South Wales.

The floating defences of New South Wales have received but little attention. The Colony possesses one efficient corvette, the Wolverene, a gift from the Imperial Government. The constant presence of ships of the Australian squadron, the impossibility of forcing an entrance into the harbour, with such a fleet as could be despatched to Australian waters, and the difficulty of effecting a landing on this iron-bound coast, have influenced the policy of the Government in its preparations to meet attack. The land defences are of a powerful character. No less than £1,500,000 have been expended in the construction of strong batteries for the defence of Port Jackson, Botany Bay and Newcastle. The armament of these works includes two 25-ton guns, six 18-ton guns, six 12-ton guns, two 110-pounders, and a large number of guns of lighter calibre of the older patterns.

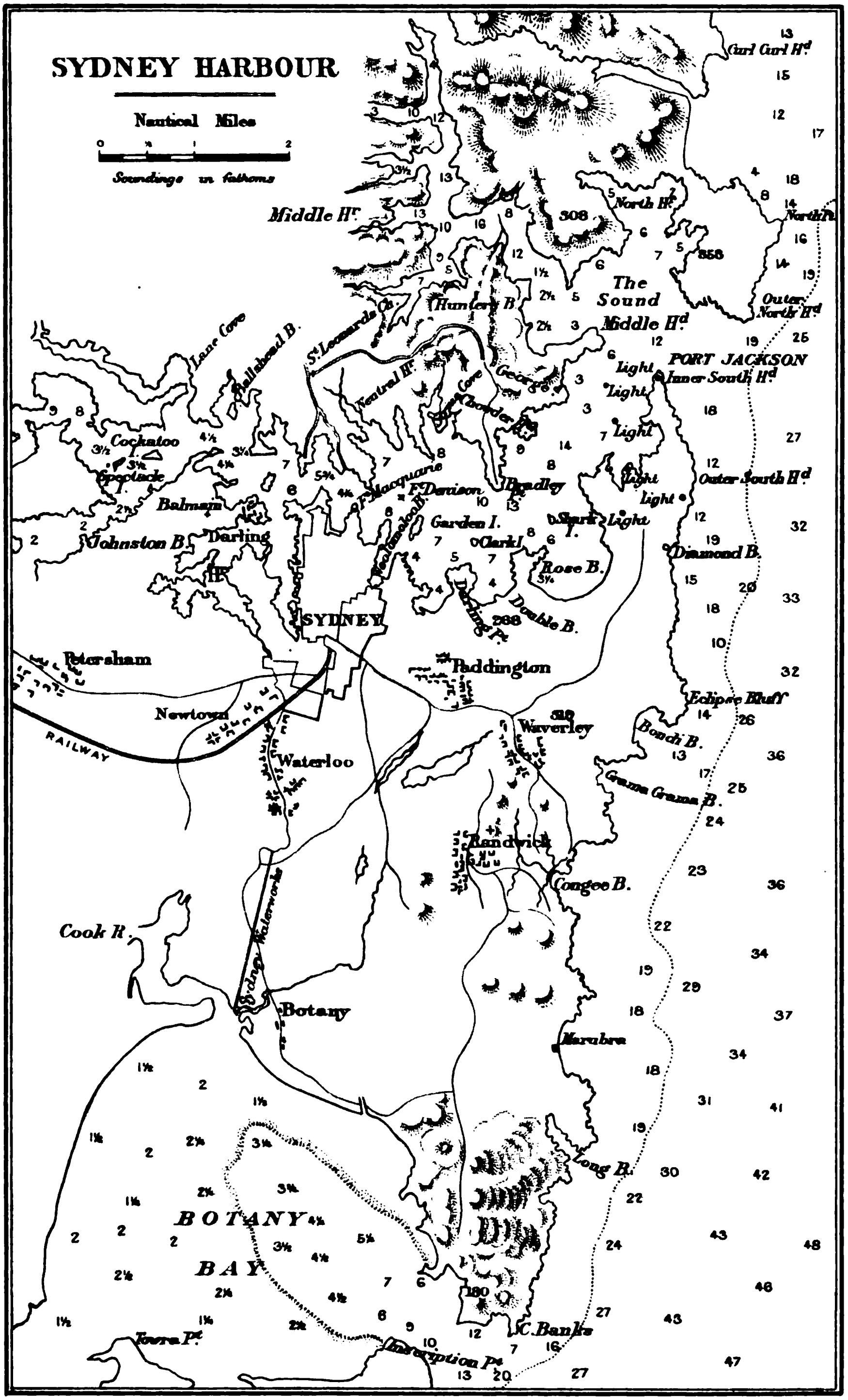
Queensland.

Queensland has a harbour defence flotilla consisting of the Gayundah and Paluma, having a displacement of 319 tons, and armed with one 8-inch, one 6-inch, and four machine guns. They were built by Sir William Armstrong & Co., in 1884. In addition to these vessels, the flotilla includes the Otter armed tender, five twin screw armed barges, one torpedo boat, and the Lucinda, Government yacht. The entrance to the Brisbane River is protected by two batteries and a system of submarine mines. Steps are being taken for making batteries at Rockhampton and Townsville.

Thursday Island.

Thursday Island is an important position, hitherto left altogether defenceless, and distant 1400 miles from Brisbane, the nearest point from which forces could be despatched. The question of fortifications was discussed in the report of the Commission on Colonial Defence.

"Witnesses from the Admiralty have drawn our attention to Thursday Island, one of a group of islands in Torres Straits, situated twenty miles North West of Cape York, the northernmost point of the Australian Continent. It is a settlement of the Queensland Government, and was selected as a convenient harbour of refuge and port of call for ships engaged in the rapidly increasing trade through the Torres Straits. Colonel Scratchley in his report, dated the 31st of



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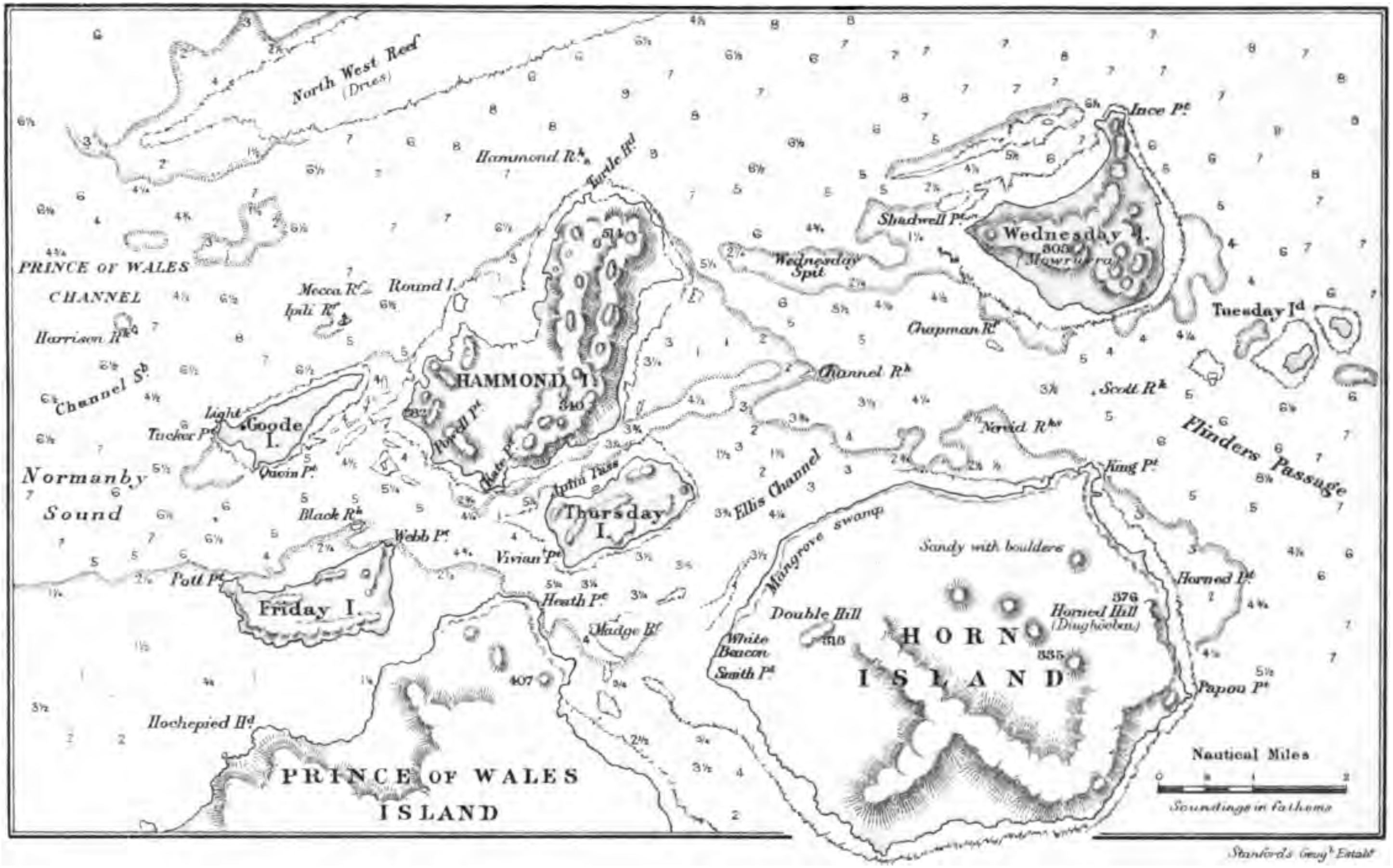
THURSDAY ISLAND.



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December, 1881, states that it is expected that in a short time the mail steamers (carrying cargo, mails, and passengers) will run every fortnight, and that in the course of a few years nearly all the trade between Queensland, the East, and Europe will be diverted northward instead of passing, as at present, *viâ* Melbourne, the Cape and the Suez Canal."

"The width of Torres Straits between Cape York and New Guinea is seventy miles, but the navigation is greatly obstructed by reefs, and two channels only are at present in use. These lie on either side of the group of islands of which Thursday Island is one; but it is stated that there are other channels, and that there is probably a deep passage near the coast of New Guinea, which, if properly surveyed and marked, would be available for the largest vessels. Westward of Torres Straits the navigation is comparatively easy, and to the eastward two main routes are available, passing respectively inside and outside the Great Barrier Reefs, which extend almost continuously for a distance of 1300 miles, in a direction generally parallel with the coast of Queensland."

Colonel Scratchley, who is supported by naval authorities, urges the importance of fortifying Thursday Island, with the double object of providing a safe depot of coals for her Majesty's ships, and of preventing its occupation by an enemy.

The Defence Commission did not recommend the construction of fortifications at Thursday Island. It seems, however, difficult to resist the conclusion that protection would be required in time of war, for our cruisers operating in the vicinity of the Torres Straits, and for the important trade which passes through those waters to and from Europe, India and China, under the British flag. The proposals for defence submitted to the Colonial Conference were not of a costly nature. The scheme provided four 7-inch rifled muzzle-loading guns, and four 16-pounders. If 6-inch breech-loading guns took the place of the 7-inch guns, the 16-pounders would not be required. The total cost of the works would be £14,800; the guns, with 100 rounds per gun, would cost about £10,000.

The defence of Thursday Island would have been undertaken by the Colonies if the Imperial Government had agreed to supply modern guns. It is much to be regretted that, through their inability to accede to the terms proposed by the representatives of the Colonies, the defence of an important port at small cost has been postponed.

The far from satisfactory discussions at the Colonial Conference with reference to Thursday Island and King George's Sound are summarised in the following extract from the *Sydney Morning Herald*:—

"Unfortunately the question next in importance to Australians, namely, the defence of King George's Sound and Thursday Island, was left unsettled, though discussed on three occasions. The War Office, represented by Mr. Stanhope, Secretary of State, wanted more from the Colonies than would be conceded, and for once all the delegates were unanimous. Of all the coaling stations of the Empire, these were the only two of any value that the War Office would not deal with liberally. They offered cannons of old patterns which no Government in Australia would nowadays think of mounting, and material for torpedo-fields; but they wanted the Colonies to do the rest—to erect the forts and barracks, and maintain the necessary garrisons. This offer was Sir James Lorimer's opportunity. Though not a soldier, he knows something of the details of defence, and he did not hesitate to expose the absurdity of placing old guns on such forts, and generally to condemn the proposal. Mr. Stanhope did not pretend that the armament was the best that could be provided, but he and his advising officers contended that it would be reasonably effective in repelling a chance attack, and in keeping tolerably safe a place of shelter for war vessels to refit, or for merchantmen when the enemy is at hand. Sir Patrick Jennings thought that the system of coaling stations would be incomplete if these two were not included, and Mr. Service opened new ground by calling attention to the relations of the Parliament of Great Britain to the rest of the Empire. The War Office admittedly, he pointed out, would not increase the vote for defending coaling stations, so as to include King George's Sound and Thursday Island, because they feared criticism in the House of Commons. This proved that some higher tribunal—an Imperial Legislature in every sense of the word—was required for dealing with Imperial affairs on sound principles apart from party considerations. Mr. Service was applauded for the point made, and its force was privately admitted by others than the delegates. It had no effect, however, on the present aspect of the case. The War Office could not then be moved to make a more liberal advance, though a day or two later Mr. Stanhope sought to bring the matter to a conclusion by asking the delegates if, supposing improved armament were supplied, they would recommend their Governments to erect the forts and maintain the garrisons. But he was met with the reply that no pledge could be given until the relative value of the British and Colonial interests in the defence of the ports named had been determined. When this was done the Colonies would be glad to con-

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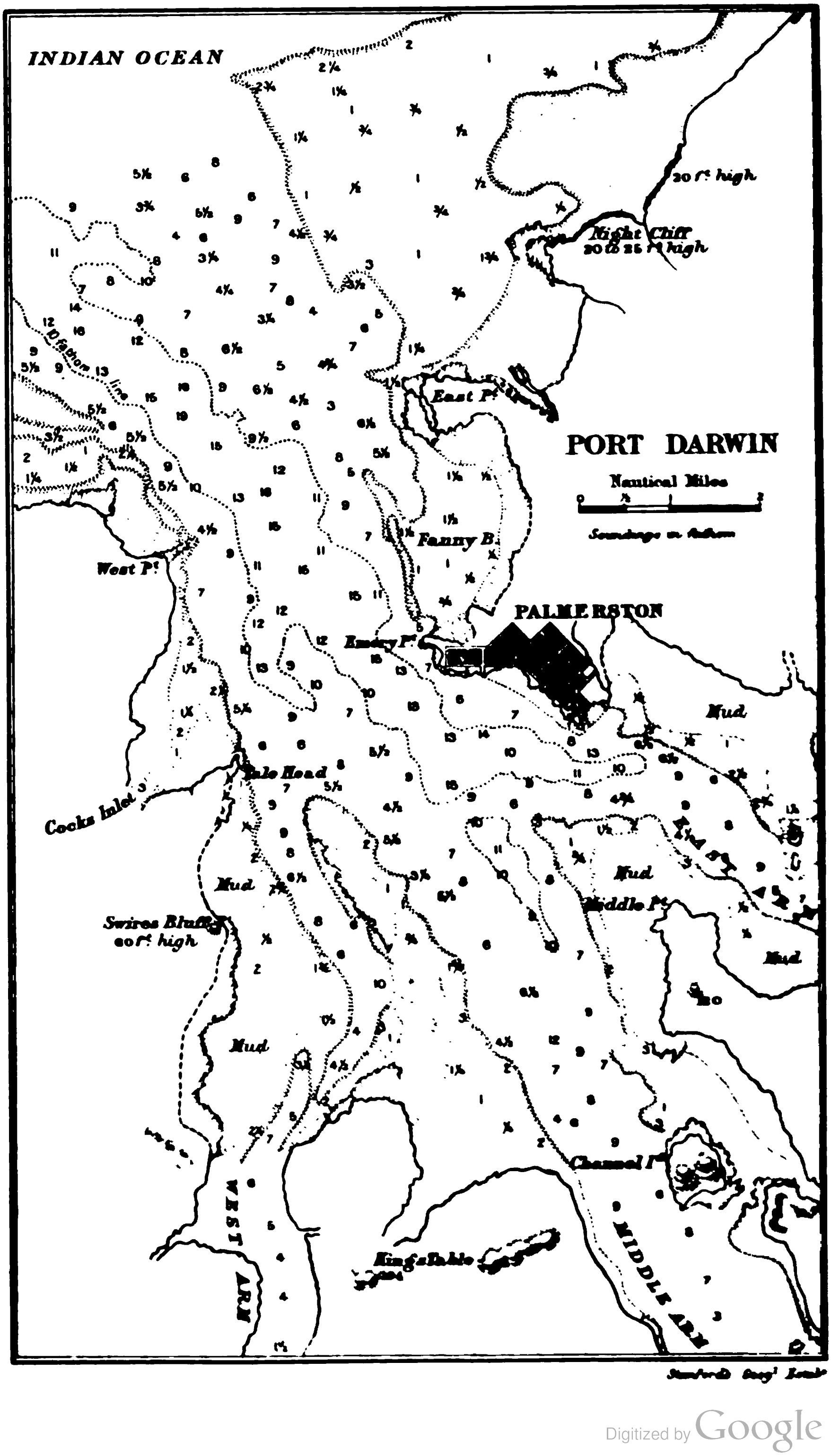

Stanford's Geog¹ Estab¹

sider any proposal for the expenditure of money up to the value of their interests. Sir John Downer was particularly strong in urging this position, but Mr. Forrest and Mr. Burt, being naturally anxious to secure a settlement of the matter so far as King George's Sound was concerned, intimated that their Colony would contribute more than its share to begin with, and in ten years would take over the entire responsibility of maintenance. But this was of no avail, for on the last day but one of the Conference it was announced that the War Office fell back upon their original offer of the old guns, their justification being that there would be less necessity for defending King George's Sound and Thursday Island when the auxiliary Australian fleet was established than if that fleet were not to be brought together. The decision was received with regret, as marking the shelving of the question, but some of the delegates were under the impression that next year a more liberal proposal would be made. The outcome was extremely unsatisfactory, seeing that the Government is taking a large share of the expense of fortifying coaling stations in other parts of the world which are not more important than the two mentioned. The late Sir Peter Scratchley examined King George's Sound, and reported that its defence was of vital importance to the security of the Australian Colonies. It was his scheme that the War Office submitted to the Conference, but when he propounded it there appeared to be great necessity for improvising rapid defence. His proposals were to meet a temporary emergency, not to supply permanent fortifications, which are now desired."

Port Darwin.

Port Darwin, the last port at which the Sunbeam touched in Australia, has a noble harbour in an important strategical position. It is distant from Thursday Island 725 miles, Singapore 2500 miles, and King George's Sound 2109 miles. The cable by which Australia holds telegraphic communication with the civilised world is here connected with the line carried across the continent with so much enterprise by the Government of South Australia. The first section from the north of the Transaustralian Railway is near completion. It will connect Port Darwin immediately with a district in which gold mining is being carried on with success, over five tons having been already exported. When the communication with Adelaide is completed, Port Darwin may become the port of landing for the mails from Europe for all parts of Australia. The harbour is already used to a limited extent as a coaling station for the Mercantile Marine. In war it would be a base of operations for our cruisers protecting the trade between Queensland, India, China, and Europe. It remains as yet absolutely defenceless. A few light guns of long range should be mounted, and a small force of Volunteers, led by permanent non-commissioned officers, should be raised. The necessity for some defence was not sufficiently brought under consideration at the recent Colonial Conference.

Naval Reserves—Victoria.

The Australasian Colonies have made considerable progress in the establishment of Naval Brigades. During a recent visit to Australia, I had an opportunity of seeing the very fine force of Naval Reserve men which has been raised in the Colonies. The Colonial Naval Reserve is recruited from good materials. Many men have seen service in the Navy; all are directly connected with shipping, and familiar with a seafaring life.

The Victorian force is organised on the plan of the English Naval Reserve, and officers and men are paid for attendance at drill, which is compulsory. The men receive £12 a year. At the date of the latest returns the Permanent Naval Force of Victoria numbered 205, and the Naval Reserve 305. The Victorian Naval Force is trained afloat, the local harbour defence flotilla comprising numerous vessels of a modern type. The training is under the supervision of a captain and gunnery lieutenant lent from the active list of the Royal Navy. A wholesome emulation exists between the Permanent Force and the Naval Brigade, the result being that great skill is shown in handling the torpedo. The drill at the guns is equally creditable. To the officers of the Royal Navy, and to Captain Fullarton, the harbour-master at Melbourne, who has been in command of the Victorian Brigade from the commencement, and the officers under his command, high praise is due for the state of efficiency to which the Victorian naval forces have been brought.

New South Wales.

New South Wales has a Naval Brigade consisting of seafaring men of fine physique, regularly drilled in all exercises which can be carried out ashore; but they rarely drill in daylight, and have seldom been exercised afloat. This force is paid at the rates fixed for the Victorian Reserve. The strength has been recently reduced from 650 to 350. This reduction was prompted by motives of economy, and is much to be regretted.

Naval Artillery Volunteers, New South Wales.

The Naval Artillery Volunteers are constituted on the same principle as the force in England. Their total strength is 250. Whether manning their boats in Sydney Harbour, or going through the cutlass exercise, or manœuvring as infantry in the park attached to Government House, the volunteers of New South Wales show high capabilities, zeal and efficiency. It is their patriotic ambition to stand shoulder to shoulder with their comrades in the old country. Equal praise is due to the Naval Brigade under Captain Hixson, R.N., an officer who, with true patriotism, is giving the benefit of the experience gained during years of good service in the Navy to the Colony which is his adopted home.

Queensland.

Queensland has a Naval Brigade 250 strong, and a corps of 50 Naval Artillery Volunteers at Rockhampton.

New Zealand.

New Zealand has a force of 1240 Naval Artillery Volunteers. There are no Naval Reserves at present, but authority has been obtained from Parliament for the establishment of a Naval Brigade.

Officers.

The training of officers is the great practical difficulty in the organisation of a Naval Reserve Force for the Colonies. Service in the Royal Navy, and instruction in gunnery ships, and torpedo school ships, are essential to qualify for the command of a fighting vessel of the modern type. Facilities should be granted to the officers of the Colonial Naval Reserves to enter for short periods of training on board ships of the Australian squadron.

The Imperial Government would render service to the Colonies by appointing officers from the Royal Navy for the training of the Naval Reserves in time of peace. If the Reserves were called out for active service, these officers would naturally fill the most important commands. These suggestions are made with the view of meeting an immediately pressing difficulty. In another section a more thorough system will be proposed for the supply of officers for the Australian Naval Reserves.

Should the proposal be adopted which will be made elsewhere, and ironclads be permanently stationed in the Colonies to co-operate in the coast defence, the Naval Reserve and Naval Volunteer forces would be greatly encouraged. The ironclad of the Colony would be a depôt, a drill-ship, and a rallying-point, and should it be necessary to commission for active service, the colonial forces would furnish the greater portion of the complement.

Military forces of Australasia—South Australia.

Having described briefly the floating defences and fixed defences of the Colonies, we turn to their military forces. The South Australia military force consists of:—

	Officers.	Men.
Permanent force	2	45
Militia (Cavalry)	6	60
„ (Field Artillery)	6	75
„ (Garrison Artillery)	6	120
„ (Infantry)	40	680
Ambulance Corps	6	15
Active Militia Reserve	6	120
Volunteers (Mounted)	8	120
„ (Infantry)	75	1,700

The physique of the force is remarkably fine. Under an able staff, and in this regard the Colony is at the present time much to be congratulated, South Australia would make a sturdy resistance to an attack. Its iron-bound coast offers few landing-places for a hostile expedition.

Victoria. The military forces of Victoria on the 1st November, 1885, are given in the following statement:—

REGULARLY EMPLOYED.

	All ranks.
H. Q. Staff	5
Drill Instructors	41
Victorian Artillery	160
Permanent Section Corps of Engineers	20

MILITIA FORCE.

Cavalry and Nordenfelt Battery	97
Artillery—3 Field Batteries	266
„ 7 Garrison Batteries	662
Corps of Engineers — Sub-Marine and Mining Co.	62
Corps of Engineers — Field Company	99
Infantry—4 Battalions of Rifles	1,808
Medical Department	16
Total	3,236
Volunteer Mounted Rifles	1,008
Grand total	4,244

The Volunteer Mounted Rifles are a magnificent body raised within the last twelve months. They consist for the most part of men accustomed to bush-life—excellent riders and good shots, mounted on wiry station-horses. The military forces of Victoria are under the supervision of a staff of officers from the regular service. Being present at Melbourne on the occasion of the Queen's Jubilee, the present writer had an opportunity of seeing 5000 of the Colonial Militia and Volunteer forces march past. The simple movements of a field day were efficiently performed, and the men were well turned out. The physical standard was little, if at all, below that of a regiment of foot guards.

New South Wales. The military forces of New South Wales on the 1st July, 1886, were as follows:—General staff, 11 officers, 2 warrant officers, and 14 non-commissioned officers; total, 27. Regular artillery, 13 officers, 5 warrant officers, and 488 of other ranks; total, 506. Volunteers partially paid, permanent staff, 52; medical staff, 5; honorary chaplains, 3; artillery, 8 batteries, 985; engineer corps, 121; torpedo corps, 247; 4 infantry regiments, each consisting of 953, equal to 3712; reserve corps, Sydney, 2 troops lancers, 122; 4 batteries of artillery, 460; 9 companies infantry, 1036. Southern district, 2 troops of light horse, 120; 21 companies of infantry, 1261. Western district, 3 corps of infantry, 180. Northern district, 5 troops light horse, 300; 13 corps of infantry, 783; medical staff, 8 officers; making a grand total of all ranks, 9928.

Queensland. On June 30, 1886, the military forces of Queensland numbered: defence force, 145 officers and 1802 non-commissioned officers and men; volunteer force, 31 officers and 829 non-commissioned officers and men. In addition to these there are police, a fine body of men, about 600; members of Rifle Clubs, 580; Marine Defence Force and Naval Volunteers, 358. The Colony has upwards of 4000 men well equipped and armed for its defence.

New Zealand. New Zealand is not exposed to danger from the operations of such fleets as any European power engaged in war with England could venture to despatch to waters so distant. Auckland and Wellington, the only towns exposed to the attacks of fleets, are now effectually defended by forts and submarine mines. The Volunteer forces of the Colony present a total strength of 8253 officers and men, and 1667 cadets. This force includes 544 cavalry and 87 mounted infantry.

Federation of the Australian Colonies has been much discussed, but hitherto without arriving at any plan which has found general acceptance. While political federation may be difficult, joint action for defence can be more readily taken. It would secure increased efficiency combined with economy.

In concluding this section of *The Naval Annual*, a tribute of well-merited praise may appropriately be given to the great Colonies of Australasia for the high sense of national duty and the public spirit they have shown in the fortification of their principal harbours. All places of considerable trade are more or less protected. Of the places not yet fortified the most important are Thursday Island, King George's Sound, Townsville and Cooktown. Townsville and Cooktown will doubtless be undertaken by the Queensland Government. The moderate expenditure required for Thursday Island and King George's Sound might in justice be divided between the Colonies and the mother-country.

CHAPTER VIII.

THE AUSTRALIAN SQUADRON.

HAVING urged the gradual reduction of forces on certain foreign stations, I earnestly recommend for the Australian station a stronger and more efficient force than has hitherto been maintained. Australian naval defence has recently entered upon a new phase. Animated by an honourable spirit of independence and patriotism, the Colonies have taken in hand the defence of their harbours; and tentative proposals were made at the Colonial Conference that they should share, in limited proportions with the mother-country, the cost of external defence.

Proceedings at Colonial Conference.

The discussions at the Colonial Conference on the subject of the naval defence of Australia were of the highest importance, and demand notice in our record of the naval incidents of the year.

Proposals similar to those laid before the Conference were first submitted to the Colonies by Lord Derby in 1885, a scheme for the purpose having been prepared by Sir Cooper Key. That scheme did not obtain adequate support. It was practically a demand for contributions from the Colonies, perhaps without a sufficient acknowledgment of their claim to control the movements of the ships. The subject, however, was followed up with ability, perseverance and tact by Admiral Sir George Tryon, and he nearly succeeded in bringing the negotiations to a satisfactory issue.

At the meeting of the recent Colonial Conference the discussion was renewed. The Admiralty approached the Conference on the basis of the proposals made by Admiral Tryon to a private conference of Premiers on board H.M.S. Nelson in Sydney Harbour. These were, briefly, that the Admiralty should supply a fleet of five cruisers of the improved Archer type for the protection of commerce, and two torpedo-boats, the existing squadron to be maintained as at present, and the additional force on no account to be devoted to other than the purposes for which it was established. The first cost of the fleet would be £626,000, and the terms proposed were that the Colonies should contribute first an annual payment of £31,000 to meet deterioration at the rate of 5 per cent., and further pay £91,000 for maintenance in time of peace, and £153,000 in time of war.

This proposal was subsequently modified by the Admiralty, the amount for maintenance being limited to £91,000 both in war and peace. The same differences of view were expressed in London as at the meeting in Sydney convened by Admiral Tryon. The representatives of Victoria, Mr. Deakin and Sir James Lorimer, maintained the attitude assumed by Mr. Gillies on the flagship, insisting that the Colonies should not be required to contribute to the depreciation fund. They contended that the local expenditure of the Colonies upon naval defence should be placed to the credit of the Governments, and that the Imperial Government should assume some share of the annual expenditure. The fleet was intended to protect commerce, which commerce for the most part belonged to England, yet England proposed to do nothing more than she was at present doing. As far as the protection of shipping was concerned, the Victorian delegates maintained that their colony had done her share in providing a local fleet. She was prepared, however, to enter into the joint arrangement, provided that she was not called upon to pay towards the depreciation fund, which should be supplied by England. After prolonged discussion, the revised arrangements proposed by the Admiralty were accepted in principle.

The present writer sought an opportunity of expressing his approval of the wise and statesmanlike measures proposed to the Conference for the common object of the defence of the Empire, in a letter addressed to the *Melbourne Argus*:—"The reinforcement of the Australian squadron with fast vessels, as recently considered and approved at the Colonial Conference in London, will, it is certain, materially strengthen the Naval forces in these waters in the particular class of ships most urgently needed. The terms of payment are alike advantageous to the Colonies and liberal on the part of the Admiralty. It is evident that no colony could hope to acquire equally efficient and reliable vessels for its defence on the easy terms which are now proposed.

"More powerful vessels might have been substituted for those of the Archer class. Steaming against the heavy rollers which continually sweep along the Australian coasts, the Archers would sometimes lose speed, while ships of a heavy tonnage would be comparatively little affected. It is obvious, however, that if more costly ships were provided, a proportionate increase must have been proposed in the Colonial contribution. Looking to all the considerations, both naval and financial, to which Governments at home and in the Colonies must have regard, it would seem the better course to accept the arrangement as it is now submitted. All the vessels promised are of new and effective types. Some powerful cruisers will doubtless be appropriated to Australia as part of the Imperial squadron. Great efforts have been devoted in recent years to building such ships, and the number at the disposal of the Admiralty is rapidly increasing."

Objections urged in the Queensland press.

Though the question was not raised at the Conference, considerable opposition has been threatened in Australia to any annual payment, however moderate in amount, which will leave the Colonies at the end of the term to which the agreement extends without a fleet. The following, from a leading journal published at Brisbane, appeared during the period of my recent visit:—

"Admitting that the squadron should be maintained, and admitting also that the delegates have probably secured the most favourable terms that the Admiralty were willing to grant, we still object to the whole system on which the squadron is to be maintained. The Colonies, it will be observed, are to pay £126,000 a year to the British Admiralty, which, in return, contracts to maintain certain war-vessels on our coasts, some fully equipped and manned, others lying in reserve ready to be fitted for sea in time of danger or emergency. The whole of this large sum will pass entirely out of our control; not a penny of it will be accounted for to any Parliament representing the taxpayers who have to provide the money. We are to bind ourselves unconditionally to pay this sum annually for ten years, and all that we receive in return is a promise that seven vessels, of what is now regarded as an advanced type of war-ship, are to be provided and maintained. Improvements may be made in the style of war-ships, but we shall have no right to stipulate for their adoption; weapons far more destructive than any now known may be used by possible foes, but we must remain content with the standard of to-day.

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"We may be told that these are the only terms on which the Admiralty will co-operate with us in the maintenance of a squadron, and that we could not by our unaided efforts maintain a sufficient naval defence for our shores. We venture to assert that, for the money we are to pay, we could maintain a very reasonable defence indeed, if the Imperial Government would grant us the assistance of its credit to provide the first cost of the squadron. If 5 per cent. interest on the prime cost is £35,000, then a capital sum of £700,000 would provide the vessels and their equipment, and with an Imperial guarantee we could borrow the sum at 3 per cent., or an annual interest charge of £21,000. That would leave over £100,000 a year for maintenance, and it would no doubt be possible by keeping only a few vessels in commission, and by a system of naval reserves, to provide for that sum the means of manning the whole squadron in time of need, and far more quickly than the reserve vessels could be equipped by the Admiralty. But if it cost £200,000 a year, it would be better to keep the control of our own squadron in our own hands, and to train Australians to defend their country rather than send round the globe to hire Englishmen for the purpose. For either it is not our duty to defend ourselves, or it is. If it is the province of the Imperial Government, we should not attempt to interfere; if, on the other hand, it is our duty to protect our own country, we should take steps to discharge that duty. Under the agreement before us, Australia may go on paying its subsidy for an indefinite time without ever getting into a position to defend herself. At the end of the term, should the Imperial Government refuse to continue the agreement, Australia would be left without a ship of the squadron and without an officer or a man trained to naval warfare, in spite of an expenditure which by that time would have amounted to over a million and a quarter. In the case of a separation from the Empire, the Colonies would be left without even the nucleus of a sea-going fleet, or the trained men to man a single cruiser. And this is an eventuality which, however much we dislike to contemplate it, we must take into account. All the pretty speeches in the world will not cover the fact that the drift of events is towards disintegration."

Arguments for strengthening the Australian squadron.

It may be easy to meet the objections urged by the writer of the above extract, and to show the fallacy involved in his assumptions. It is not the less evident that if we desire to maintain our noble Empire under one flag, with all the advantages to every member of the Empire which its union in action and unanimity in sentiment will secure, we must stand prepared to do all that we can to convince the Colonies of the benefits they derive from their present connection. This brings us to the proposal, to which the present chapter is specially devoted, for a reinforcement of the Australian squadron, with a redistribution, if necessary, of ships on certain foreign stations.

The strength of our squadrons abroad obviously depends upon the varying course of political events, and is only by gradual steps adapted to such new responsibilities as the course of trade imposes on the Imperial Government. A disturbed condition of affairs leads to a concentration of our naval forces. The emergency passes away. The ships remain until new complications arise elsewhere. We have ships at the present time on the coasts of North and South America, for which, in view of the cordial relations now subsisting between England and the United States, it is highly improbable that serious duties can be found. In Australia, on the other hand, the growth of population, and the increase of trade, as measured in exports and imports within the period embraced in Her Majesty's happy reign, from nine millions sterling to ninety-five millions sterling, has not been followed by a proportionate strengthening of our Navy in those waters.

To enter into details lies outside the scope of the present writer. It may, however, be suggested that the South-East coast of America should cease to be a separate command, and be added to the cruising ground of the North American squadron; or the Cape command might be extended, like that of the French squadron, to both shores of the South Atlantic. In either case the cruises of the training squadron or the Channel Fleet might be occasionally extended to the South American ports.

Some reduction appears practicable on the Pacific station.

The East India station has long been a drain on the *personnel* of the Navy. The unrelenting heat experienced on a station lying wholly within the tropics causes a large amount of invaliding and a serious deterioration of health in cases not sufficiently grave to necessitate the removal of the men from their ships. A specimen case may be given from the *Army and Navy Gazette*:—"During our three years' cruise we have invalided seven officers (one of whom, our captain, died shortly after his arrival home) and twenty-four men, out of a ship's company of ninety-eight officers and men. In conclusion, I may say there is no higher temperature on any station than on that of the Persian Gulf." The duties of the squadron in the Persian Gulf should be transferred to the Indian Marine, thus securing a further saving to meet increased expenditure in Australia.

A proposal to increase the Australian squadron commends itself on many grounds. The climate being entirely suitable to British crews, the ships can be maintained on this station in the highest state of efficiency. The geographical position of Sydney, in reference to India, China, and the Pacific station, would facilitate the despatch of reinforcements on an emergency. The presence in Australian waters of a larger force than heretofore would have an excellent effect upon Colonial opinion. It would strengthen the hands of those who desire to preserve the connection with the mother-country against the party whose watchword is "Australia for the Australians," and who, though feeble as yet in numbers, might grow in influence if the mother-country were to show a chilling indifference to Colonial concerns.

Proposed strength of Australian squadron.

Taking that enlarged view of the claims of Australia to more ample naval protection, which seems amply justified by the considerations which have been urged, it would seem the duty of the Admiralty to make the Australian command the most important in the service beyond the limits of European waters. It is not easy to fix an exact standard of strength, but Australia naturally watches with anxiety the Russian fleet in the Pacific. In a recent issue, the Melbourne *Argus* gave the following list of ships obtained from Major-General Downes, the Permanent Head of the Defence Department of the Victorian Government:—

RUSSIAN FLEET.

Name.	Tons.	I. H. P.	Speed.	Armour.	Heavy.	Light.	Machine.
ARMOURED.							
Dmitri Donskoi . . .	5,893	7,000	16	6 in.	16	4	10
Vladimir Monomach . .	5,796	7,000	15·4	6 in.	16	4	4
Duke of Edinburgh . .	4,602	5,222	13	6 in.	10	6	2
UNARMOURED.							
Opritchnik	1,426	1,685	13	..	8	4	6
Nayejdnik	1,334	1,719	13	..	4	2	6
Razbojnik	1,329	1,786	13	..	3	4	5
Djigitd	1,456	1,383	12	..	3	4	4
Siboutch . . . . . }	950	..	14	..	2	6	2
Betvi . . . . . . }							

BRITISH SQUADRON.

ARMOURED.							
Nelson	7,630	6,640	14·4	..	12	2	15
UNARMOURED.					Medium.		
Opal	2,120	2,190	13	..	12	2	6
Diamond	1,970	2,140	12½	..	12	2	6
Rapid	1,420	1,400	13	..	12	1	4
Swinger.	430	520	..	..	4	..	..
Raven	465	360	..	..	4	..	..
Dart	470	200	..	..	..	2	..

The *Argus* demands that steps should be taken to put the Australian squadron into a better position to meet the powerful forces which have been massed under the Russian flag in the Pacific. If we are prepared, even in a partial sense, to adopt the view of Baron Hübner, that the protection afforded to the Colonial trade by the Imperial Navy is the chief advantage secured by connection with England, we shall lose no time in taking the necessary action. The following seems a not unreasonable standard of strength at which the Australian squadron should be maintained :—

In Commission.

	Number.	Type.
Ironclad	1	Nelson or Imperieuse.
Belted cruiser	1	
Corvettes	2	Gem or "C" class. For war service crews to turn over to armed merchant steamers and belted cruisers.
Gunboats	2	
Small cruisers	4	Dart class rigged as Sunbeam. For police of the islands and New Guinea.

In Reserve.

Belted cruisers	2	
Armoured	4	distributed as under :—

1 Commodore's pendant in New Zealand.
1 Depot ship for Naval Brigade, Hobson's Bay.
1 Depot ship for Naval Brigade, Adelaide.
1 Depot ship for Naval Brigade, Sydney.

Four principal objects are contemplated in the re-organization of the Australian squadron as here proposed.

I. To provide a defence against attacks from ironclads with ships of equal or greater power.

II. To provide for the defence of commerce by cruisers of the latest and most effective type.

III. To have in reserve, in the corvettes, officers and crews to man the mercantile cruisers which should be employed in the postal service of Australia.

IV. To carry on the police of the Pacific by means of smaller vessels than those at present detailed for the service.

It is for this latter purpose that additional cruisers of the Dart class are suggested. Cruising among the islands of the Pacific is a trying service. The crews are necessarily fed entirely on salt provisions. The heat is intense. The islands are unhealthy ; and there is much invaliding in the ships detached for this service. A further considerable economy of men might be effected by removing half the guns from the corvettes of the Gem class, and keeping the ships in commission for police duties in the Pacific, with a considerably reduced complement. A few large ships are required, because the officers doing the duty of Deputy Commissioner for the Pacific are selected from the Captain's list. The Gem class with much reduced armaments would possess an overwhelming weight of metal for the punishment of savages for murderous attacks on unarmed traders.

Gun vessels of the Swinger class are not efficient as cruisers for the Pacific islands. They are admirably adapted for drilling the Colonial Naval Reserve, and should visit all ports in which Colonial Naval Reserve men have been enrolled.

Annual manœuvres.

The ironclads in Australian waters, like those of the Reserve Squadron at home, should be assembled under the Admiral annually for exercises, such as those carried out in 1885, on the coast of Ireland, under Admiral Hornby. The *rendezvous* should be changed from year to year, thus affording to the fleet a wide experience of Australasian navigation, and giving to the several Colonies the satisfaction of seeing the squadron, to the maintenance of which they have undertaken to contribute.

Ironclads in reserve.

The ironclads to be placed in reserve may, perhaps, be considered the least useful addition to the Australian squadron. They are suggested both as a means of strengthening the coast defence, and as an encouragement to the Colonial Governments to maintain and to add to their naval forces. As to their value for coast defence, we have the opinion of Sir William Jervois quoted in Sir Peter Scratchley's book on Australian Naval Defence. "In the event," he says, "of Great Britain being engaged in hostilities with any maritime power, the enemy would retain the most powerful portion of his fleet in European waters or in the Atlantic. If he sent his fleet, or any considerable portion of it, on an expedition against the Australian Colonies, a sufficient part of our home fleet would, in turn, be set free to intercept it. But whilst the bulk of the enemy's naval forces would be occupied on the immediate scene of action in Europe, he might, no doubt, despatch one or more cruisers to operate against our maritime commerce, or make a descent upon any of our Colonial possessions. A squadron, intended for such an operation, might consist of three or four vessels, one or two of which might probably be armoured, and might issue from the Russian ports of Vladivostock, and Petropaulovski, or from the French port of Saigon. Eluding our cruisers, and appearing suddenly before Melbourne, Sydney, Adelaide, or Moreton Bay, it might capture the merchant vessels lying in the harbours, intercept any of the numerous vessels conveying valuable shipments of gold, or, under threat of bombardment,

Sir William Jervois.

or after actually firing into one of the large towns, demand and obtain the payment of many millions of money. The most effective and economical means of providing for the defence of the harbours along the coast, for the protection of local commerce, and to prevent Sydney being shelled by ships lying outside the harbour defences, would be to provide an ironclad vessel superior to any enemy's ship likely to go into Australian waters."

Sir Peter Scratchley.

We have the opinion of Sir Peter Scratchley himself, in his memorandum on the defence of Victoria:—"The Cerberus not being a seagoing vessel, an additional ironclad would no doubt be valuable for the protection of the commerce at sea; but the provision of such a ship is a question, which rests upon a different basis to that of the purely local defences of Port Phillip, and the wealth placed upon its shores. It will be desirable that this part of the defences should be adapted for the defence of Australian commerce generally, and for the general protection of harbours on the Australian coast, for which local defences cannot be provided."

Sir Peter Scratchley returns to this subject in dealing with the defences of South Australia.

"It should be observed that Adelaide is much more open to attack, whether by sea or by a force landed for the purpose, than either Brisbane, Sydney or Melbourne. Brisbane is situated on a narrow river many miles from the sea; Port Jackson can only be entered by a narrow passage, which can be perfectly defended; Melbourne can be thoroughly defended by torpedoes, and by forts on the shoals within the entrance to Port Phillip; and all three capitals of Queensland, New South Wales, and Victoria are more or less difficult of approach by an enemy who might desire to attack them by land. On the other hand, the coast in the vicinity of Adelaide is a low, open, sandy beach, on any point of which an enemy could land, and from whence an approach to the city is clear and open, with abundance of good roads; whilst Port Adelaide is entirely exposed to attack from seaward. The defence of the capital of South Australia is therefore more dependent on naval means than any of the capitals of the other Australian Colonies. Taking all the circumstances of the case into consideration, I have no doubt that the best defence of Adelaide and its port, as well as of the commerce of South Australia, would be to provide a vessel of war superior in power to any hostile cruisers that would be likely to appear in these seas. Such a vessel, taking up her position in the bay on the north side of Kangaroo Island—where there is excellent anchorage, where she could be communicated with by telegraph from Cape Borda, from Sydney or

Melbourne, from Adelaide and other places, and whence she would be in a position to move either westward through Investigator Straits, eastward through the Backstairs Passage, or up St. Vincent's or Spencer's Gulfs, as occasion may require—would be able to afford an active and effective defence against attacks to which this Colony is most likely to be exposed."

Ironclads for harbour defence abroad.

The distribution of the ships in reserve to the more distant parts of the Empire is not a novel proposal. The Scorpion and Wivern have long formed a valuable part of the local naval defence force at Hong Kong and Bermuda. The Nelson was presented to Victoria and the Wolverene to New South Wales.

The question of the disposal of the ironclads of an earlier date will shortly press for the decision of the Admiralty. The squadrons near home will be completed with ironclads of the most recent type. The vessels withdrawn from the European squadrons would be available for distribution to the Australasian ports, where they would add materially to the local resources for the purposes of coast defence. The Colonial dockyards would be utilised for the necessary repairs. Ship-keeping parties could be drafted from the local naval force. The crews for war-service would be obtained from the Colonial naval brigades.

Objections to a reinforcement of the Australian squadron considered.

An ably conducted Service journal took exception to the present proposal, as originally suggested in a letter to the *Times*. The objection rested on the incontestable proposition that any naval defensive force must be placed where the enemy is, not where he is not. I hoped I had made it clear in my letter that the additional ships recommended for the Australian squadron were not necessarily to remain on the station in war. Upon the anticipation of hostilities, they would at once be despatched to collar the enemy wherever he might happen to be, and Sydney, from its geographical position, is a convenient centre whence reinforcements could be despatched to any portion of the Chinese or the Indian stations.

Allusion was made in the same letter to the Russian naval force at Vladivostock as a source of some uneasiness in Australia, and as affording a just ground for the demand that the naval force available for Australian defence should be strengthened. Our Australian cousins share with ourselves the weaknesses of humanity. Statistical returns on paper do not exercise the same moral effect as force, whether naval or military, visibly present. The Australians would like to see something more of the fleet on which they are invited to depend during war, and in this they do not differ widely from those great maritime communities at home, for whose gratification, and rightly so, the Channel Fleet is from time to time despatched on a voyage of circumnavigation around the coasts of the United Kingdom. At home exalted personages, from the monarch to the representatives of the taxpayers, find a natural satisfaction in the reviews occasionally held at Spithead.

Conditions in postal contracts.

It may be suggested as a further means of reinforcing the Australian squadron, that in any new postal contracts it should be stipulated that the vessels should be capable of steaming at least 17 knots on the measured mile; and fulfil the conditions stated in detail in the section on mercantile auxiliaries. Under existing arrangements, two of the splendid steamers carrying the Australian mails are always present in Sydney Harbour; an additional vessel arrives every week. We can man these vessels by turning over the crews from ships which have become obsolete for war service, although in many instances highly efficient for training and for police of the seas.

CHAPTER IX.

A COLONIAL BRITANNIA.

IN an honourable spirit of independence and patriotism, the Australian Colonies have recently taken in hand the defences of their coasts and harbours. Fortifications have been constructed and armed, gun vessels and torpedo boats of the latest type have been purchased, naval brigades have been organised, and naval volunteers have been enrolled. In view of these efforts, the training of officers for the Australian sea services has become a question of urgent importance.

Education of cadets for Imperial Navy at Dartmouth.

It will be admitted that professional knowledge will be more satisfactorily acquired in the wide field of experience open to the Imperial Navy, than in the narrow sphere of a local defensive force. The preliminary education of our naval cadets has been conducted for many years on board the school ship Britannia, at Dartmouth. The results are shown in the high standard of professional attainments in the naval service. It is desirable to secure for the future officers of the colonial naval forces the same advantages of education and training as are provided at home. Under recent regulations, candidates from the colonies are nominated to the Britannia and the colleges for engineering students. The nominations are too few to provide officers for a force of Naval Reserve adequate for the defence of Australasia. In a colonial Britannia, the education and training, now only obtainable in England, could be given without demanding from colonial cadets the hard sacrifice of separation from home, for several years, at a critical age. A naval school organised on the lines of the Britannia would afford a two-fold advantage. While supplying officers to the colonial Naval Reserve, it would give to the colonies a school possessing from the commencement good traditions and a stimulating *esprit de corps*, which in an ordinary public school must be of slow growth. In a military or naval school the boys adopt at once and instinctively the tone of the great services with which they are connected. Such has been the experience of the

Advantages of a similar naval school for Australasia.

military school of Canada. A colonial Britannia would be similarly strengthened by its naval associations. The ideas thus generally indicated, conceived at home, and without local knowledge, have been confirmed by a personal visit to Australasia.

A military school recommended on similar grounds by Brigadier-General Owen, R.A.

In confirmation of personal impressions reference may be made to a memorandum prepared by Brigadier-General Owen, R.A., the able commandant of the military forces in South Australia. After three years' experience in the colony, he has proposed a scheme of military education in principle identical with that here submitted for the Navy.

Adopting the suggestions of other Imperial officers, and those made by the Royal Commission, which met at Sydney in 1881, General Owen recommends the establishment of a military college, to be maintained by joint contributions from the Australian colonies. To avoid intercolonial jealousies, and on the ground of its temperate and salubrious climate, he suggested that the college should be located in Tasmania. It would be possible to combine the naval school with the military college recommended by General Owen.

Course of education in naval school.

It would be premature at present to go beyond the general outline of a plan of naval preparatory education. In all that relates to naval supervision, discipline, age of admission, and the course of instruction, it would be well in the first instance to follow the Britannia. The course of education would embrace a general foundation of scientific knowledge with a special training in naval subjects.

Career of colonial naval cadets.

Having dealt with their early education, the subsequent career of colonial naval cadets may be briefly traced. On leaving the naval school, they should serve their first commission in the Australian squadron. This arrangement would afford opportunities for spending an occasional interval of leave at home. On the completion of his service as midshipman, the young colonial officer would pass for lieutenant at Greenwich. After serving through one commission in that rank, he would be eligible for an appointment in the naval defence forces of his colony.

Some colonial officers might prefer to remain in the Imperial Navy. In following a naval career, they would help to make the Navy a yet stronger connecting-link between the several members of the British Empire. Their advance to important commands would be watched with pride. Their position in the Navy would be alike honourable to themselves and gratifying to the colonies.

CHAPTER X.

SHIPBUILDING POLICY.

THE shipbuilding policy of the Admiralty is always a topic of interest from its inherent importance, and because it is chiefly in this branch of administration that successive Boards of Admiralty are able to give a new direction to the expenditure upon the Navy.

Ships lately launched.

As a preliminary to the consideration of the shipbuilding of the future, the work, recently completed or in progress at home and abroad, should be passed in review. Of the ships recently launched for the British Navy, the Victoria, Sans Pareil and Trafalgar, described in Section II., are the most important.

Victoria and Sans Pareil.

Trafalgar.

The Trafalgar, a sister ship to the Nile, was launched at Portsmouth in September 1887. A French writer, in *Le Yacht* of the 10th September, summing up his description of the Trafalgar, compares her to the Dreadnought, increased in size, more powerful, with higher speed, having in addition to the 67-ton guns, a considerable minor armament and more effectively protected with armour. The writer directs particular attention to the substitution in the ships of the Admiral class of barbette towers for the enclosed turrets of the Inflexible and the earlier citadel ships, and to the return to closed turrets in the latest ironclads—the Trafalgar and the Nile, the Sans Pareil and Victoria.

Admiral class.

The other ironclads advancing to completion for the British Navy are of the Admiral and belted cruiser classes. Both types are described in the first number of *The Naval Annual*, and in Section II. of the present publication.

Belted cruisers.

Five belted cruisers have been launched from the contractors' yards, and are to be completed in 1887–8. Two similar ships are under construction in the dockyards. They are to be completed in 1889–90. The belted cruisers promise to be highly successful. They have received the authoritative approval of the present Board of Admiralty, by whom two additional ships of this type have been laid down.

Italian battle-ships.

We may now glance at the armoured construction in progress on the Continent. The types adopted in Italy were fully described in the first issue of the *The Naval Annual.* Hugeness both in the ships and the guns, great qualities of speed and coal endurance, removal of armour from the water line, and a deep draught of water, are the characteristic features of the modern armoured fleet of Italy. The ideas accepted have been carried out in a manner which reflects great credit on the naval architects and shipbuilders of Italy.

Italian ships protected rather than armoured.

The construction in progress for the Italian Navy should be classed rather with our protected ships than with the ships defended with belts, which alone, according to Sir Edward Reed, are entitled to be reckoned as armoured.

The Italians are building and completing six great ships:—

	Tons.
Andrea Doria **Ruggiero di Lauria** **Francesco Morosini**	11,000
Umberto **Sardegna** **Sicilia**	13,251

France has an ancient reputation for shipbuilding, which has been worthily maintained. The characteristic features of the French ironclad battle-ships are the fine models, securing good speeds with moderate power, retention of armour on the belt, and absence of armour on the lofty sides, the height at which the guns are carried, and the system of armament consisting, in all the larger ships, of four heavy guns mounted *en barbette* on the upper deck, and a minor armament of light, long-range guns on the main deck, not fought behind armour, and a large number of machine and quick-firing guns.

Neptune.

Four ironclads are now building for the French Navy of the same type as the Neptune, launched on the 7th of May, 1887. The following details are borrowed from *Le Yacht.* For plans see Section II.

The principal dimensions are:—length 330 feet, breadth 65 feet 7 inches, mean draught of water 26 feet, displacement 10,582 tons. The hull is of steel, constructed on the cellular principle, and divided into numerous water-tight compartments. The armour consists of an armoured deck, extending from end to end above the vitals of the ship, and plated with three-inch armour. The armour belt is of a maximum thickness of 18 inches amidships, tapering to 12 inches at the stern, and 9 inches at the bow. The bow compartment of the ship is covered in with an armoured deck, and filled with cellulose as far aft as the foremost transverse bulkhead.

The sides of the four barbette towers are protected with 16-inch armour. A cupola-shaped hood, plated with 2½-inch armour, protects the guns' crews and the mechanism of the guns from musketry fire. The communications with the magazines are protected with 5-inch armour.

The armament consists of two 34-centimetre or 52-ton guns, and two 23-ton guns mounted in four barbette towers, two in the centre line and two on the sides of the ship. The minor armament includes twenty light guns, one mounted in the bow and sixteen on the broadside, and numerous quick-firing guns on the upper deck. The Neptune class will be fitted with four torpedo launching tubes; they will be rigged with military masts. The engines will develop with forced draught 12,000 horse-power. The supply of coal is 600 tons, and the estimated speed 16½ knots. The crew will consist of 400 men. The cost of the ship is estimated at 6,800,000 francs for the materials, 3,200,000 francs for the labour, and 3,000,000 francs for the machinery. The total cost may be taken at £600,000. The Neptune will be completed to $\frac{67}{100}$th at the end of the present year. It may, therefore, be expected that she will be ready for her steam trials in 1889. There are three other ironclads building similar to the Neptune; the Marçeau, building at La Seyne, the Magenta at Toulon, and the Hoche at Lorient.

Pelayo.

As a recent example of the type of battle-ship at present in favour in France, a detailed description may here be appropriately inserted of the Pelayo, now building by the Société des Forges et Chantiers for the Spanish Navy. For illustrations, see Section II. The description is taken from *Le Yacht* of the 19th February, 1887. The contract for the construction was settled in November 1884, and the ship will be completed early in 1888. The whole of the machinery and fittings, including the hydraulic machinery and electric light, have been supplied by the Société des Forges et Chantiers. Nothing will remain to be done by the Spanish Government beyond putting the guns on board.

The Pelayo is built entirely of steel supplied from the French manufactories. The hull is constructed upon the cellular principle. It is protected by an armoured deck, which will be above the water line when the ship is fully laden. At the water line the ship will be protected from end to end by an armoured belt. A double bottom has been constructed extending nearly the full length of the ship. The space between the inner and the outer skin is divided into 98 water-tight compartments. The hull above the double bottom is divided into numerous compartments by sixteen transverse bulkheads. The engine-room, stokehold, and magazine, are divided by a longitudinal water-tight bulkhead, carried up from the keels on to the armoured deck. There are in all 145 water-tight compartments. These, as well as the double bottom, are connected with two rotary pumps, each capable of discharging 500 tons of water an hour. The bunkers, which will contain 700 tons of coal, are placed forward and on each side of the stokeholds. They thus supply extremely effective protection in that part of the ship which is above the armour belt and above the line to which the double bottom is carried. The magazines are arranged in three sections connected with the turrets to which they supply ammunition. The engines are on the compound principle. The indicated horse-power with forced draught will be 8000, and the speed will certainly be 16 knots.

The crew will number from 500 to 600 men.

The heavy armament consists of two 12½-inch or 48-ton guns mounted in towers on the centre line of the ship, one forward and the other aft. Two other 11½-inch or 38-ton guns will be mounted in two turrets on either beam in the centre of the ship, thus forming a quadrilateral with the two turrets near the ends of the ship. These turrets being built above the upper deck, the axis of the guns will be more than 25 feet above the water. The foremost tower is raised above the forecastle, and the guns will be 31 feet above the water line. The guns will be worked by hydraulic power. The minor armament consists of 12 Hontoria 4½-inch guns, one of which is mounted in the forecastle. The armament is completed with a large number of Hotchkiss guns. The Pelayo will be fitted with seven torpedo launching tubes above the armoured deck. The belt is of Creusot steel, the upper strake of 18-inch, and the lower of 12½-inch armour. The armoured deck will have a thickness of four inches.

Russian ironclads.

The ironclads of different dimensions of recent types, now building, or recently completed, for Russia, in the course of execution of the new programme, are seven in number in the Baltic, and three in the Black Sea. The seven in the Baltic are:—Vladimir Monomach, Dmitri Donskoi, Admiral Nachimoff, Alexander II., Alexander Newski, Nicholas I., and the Remembrance of Azoff. A general description of these ships has been published in *Le Yacht*.

Vladimir Monomach and Dmitri Donskoi.

The Vladimir Monomach and Dmitri Donskoi are armoured cruisers of the Duguesclin type. Differing slightly in armament, they have approximately the same dimensions. Length about 300 feet, beam 52 feet 6 inches, draught of water 25 feet, displacement 5796 tons, thickness of the armoured belt 6 inches. The armament of the Vladimir consists of four 8-inch guns mounted in barbette towers, twelve 6-inch guns in the battery, ten machine guns, and two torpedo launching tubes. The 8-inch guns are mounted like those of the Duguesclin, two on the centre line of the ship, and two forward on the sides on sponsons. The Dmitri has only two turrets for the 8-inch guns, which are mounted forward on sponsons. The battery is armed with fourteen 6-inch guns. The machinery for each vessel is of about 7000 horse-power. The Dmitri Donskoi is propelled by a single screw with four blades; the Vladimir Monomach by twin screws. Both have attained speeds of 15½ to 16 knots.

Admiral Nachimoff.

The Admiral Nachimoff is a very powerful ironclad resembling the English Imperieuse. The hull is built partly of iron and partly of steel, and has a wooden skin coppered. The principal dimensions are:—Length 331 feet, breadth 61 feet, displacement 7780 tons. The machinery will develop 8000 horse-power, giving a speed of 16 knots. The armoured belt, extending from end to end, has a thickness in the centre of 10 inches. The armament consists of four 9-inch guns in four barbette towers, the arrangement of the turrets being in the lozenge form. The armour on the turrets is twelve inches in thickness.

The Alexander Newski will probably be similar in type, and have the same armament as the Dmitri Donskoi.

Alexander II. Nicholas I.

The Alexander II. and Nicholas I. are two ironclads constructed from the same designs. Their principal dimensions are:—Length 326 feet, beam 67 feet, displacement 8440 tons. They are armoured at the water-line with a belt 9 feet 9 inches in depth, having a thickness in the centre of 12 inches, decreasing towards the extremities to 6 inches. The armoured deck is protected by 2½-inch plates, and is above the water-line. The ships have a single turret carrying a pair of 12-inch guns. The turret is protected by compound plates from 10 to 12 inches in thickness. On the main deck will be mounted four 9-inch guns, and eight 6-inch guns unprotected by armour. The minor armament will include six Hotchkiss guns and four torpedo launching tubes. The engines will be compound, 8000 horse-power, driving twin screws, and will give a speed of 16 knots. These two ironclads are building near St. Petersburg, in the yards of the Franco-Russ Company. The Remembrance of Azoff, the other vessel building in the Baltic, has a length of 378 feet, beam 49 feet 6 inches, displacement 6000 tons. This will be the longest ironclad in the Russian Navy.

Remembrance of Azoff.

Ironclads for the Black Sea.

The three ironclads of the Black Sea fleet are the most powerful in the Russian Navy. They are being constructed from the same designs. The Tchesmé was launched at Sebastopol on the 18th May last, and the Catherine II. on the 21st of the same month at Nikolaieff. The Sinope is under construction at Sebastopol. They have the following principal dimensions:—Length 314 feet, beam 69 feet, draught of water 24 feet, displacement 10,150 tons. These ships may be described as armoured turret ships, having their barbette turrets protected by a citadel in the form of a trapezium with the angles rounded off. The redoubt contains three revolving turrets. On each are mounted two 11·8-inch, or 50-ton guns, mounted on disappearing carriages, on the plan invented by Lieutenant Raskazoff. The turrets and citadel are so arranged that the guns are scarcely seen in the firing position. The citadel rises 21½ inches above the surrounding deck. It is protected with compound Cammell plating 11·8 inches in thickness, with a teak backing of the same thickness, and fixed to a strong metal framework. The armoured belt has at the centre a thickness of 16 inches, diminishing towards the extremities. On the main deck is mounted a battery of seven 6-inch guns, of which one is mounted in the stern. The estimated speed is 16 knots, with 11,000 to 13,000 indicated horse-power.

Austrian ironclad.

At the commencement of April the Austrian ironclad Princess Imperial Stephanie was launched at Trieste. The following are the principal dimensions:—Length 276 feet, beam 66 feet, draught of water 20 feet, displacement 5100 tons, 6500 horse-power, speed 15 knots. This ship will be protected by an armoured belt 8·6 inches in thickness. The barbette tower will be protected by eight-inch armour. The armament consists of two Krüpp 12-inch 36-ton guns mounted in the turret. The minor armament will consist of six 6-inch guns and eleven guns of small calibre, and six quick-firing guns. This small ironclad will carry a supply of 400 tons of coal.

Methods of protection.

In reviewing the armoured construction of 1887, some reference must be made to the long-standing controversies between Sir Edward Reed and Sir Nathaniel Barnaby, both highly esteemed friends of the present writer. In the forcible terms which he well knows how to use, Sir Edward Reed condemns the belts of the Admiral class as too short, and the belt of the Imperieuse as too low.

Imperieuse.

In the case of the Imperieuse, the results of an official verification were made known by Lord George Hamilton, in answer to a question in the House of Commons:—

"The alleged difference between the actual and designed draught of this vessel has been carefully investigated by the present Board of Admiralty, and we have ascertained that—(1) When the ship is complete with all her stores and coal on board, as designed, she will be 11½ inches deeper than her original designed line. This is due to known additions of weight of armament, machinery, &c., which have been accepted during the building of the ship, by which her speed has been increased to 17 knots as against 16 knots in the design. (2) In this condition the height of the three torpedo ports (lower edge) will be respectively—forward, 2 feet 10½ inches; amidships, 3 feet 2½ inches; aft, 2 feet 4½ inches. The height of the armour or belt deck will be 2 feet 3½ inches. (3) She was designed to have a 3-foot armoured freeboard, and this has been reduced, as above-stated, to 2 feet 3½ inches. (4) She was designed to carry 400 tons of coal (as an average quantity) at her normal draught, with power to stow 900 tons when required. In subsequently settling the details of internal arrangements, it has been found possible to stow as much as 1130 tons. Any quantity carried beyond the 400 tons of course means increased immersion. The extra immersion due to carrying 900 tons of coal is 14 inches beyond the 11½ inches above stated, or 2 feet 1½ inches. (5) The ship is to be sent to sea for an experimental cruise in company with the Colossus, starting with 900 tons of coal. The designers are quite satisfied with the stability, which is not at all appreciably affected by the increase of draught. (6) The cost of hull and machinery is about £485,000. (7) The sister ship Warspite will be in the same position."

That 400 tons of coal was an inadequate supply, on leaving port for an extended cruise, is too obvious to require discussion. It is not quite so clear that it was a mistake to fix the position of the belt with reference to the immersion of the ship, when laden with that quantity of coal. The immersion with the four hundred tons is a rough average between the condition with full and with empty bunkers. The Imperieuse, with full bunkers, is protected by coal. As the coals are consumed, the belt is relied upon for protection; and in the light condition it gives more protection to the water-line in its present position than it would afford if carried round the ship at a higher level.

Imperieuse. Captain Fane's report.

As a member of the Board by which the Imperieuse was laid down, I read with satisfaction the favourable report of Captain Fane. That ship can scarcely be other than a valuable addition to the Navy which "steams easily 16 knots, the engines on an extended cruise having worked smoothly and well, and given every satisfaction;" which "carries a powerful armament of four 9-inch breech-loading armour-piercing guns, and six 6-inch breech-loading guns:" which in point of steadiness of "gun-platform is unquestionably good;" which is "buoyant and lifts easily and well to the sea;" and whose qualities are summed up as "those of a fast cruiser and powerful fighting-ship which with her effective armament and great speed would prove a formidable opponent to an enemy."

Full protection unattainable. With Sir Edward Reed we may wish that the belts of the Admiral class were longer, and that the belt of the Imperieuse was higher or deeper. It would be more difficult to say which of the good features of either class should be sacrificed in order to appropriate a materially larger proportion of the weight available for armour to the defence of the water-line. This, at least, is certain, that when the belt has been lengthened and raised, we are still far from securing invulnerability in the most huge and costly structures we can place upon the water. The belt gives no protection against the torpedo, none against the ram piercing below the water-line, none against quick-firing guns pouring in high above the water-line a withering fire. Men will be crowded at quarters at the light guns in the batteries, and whether in belted ships or citadel ships in all the types which have thus far been produced, the crews are without protection by fixed armour, and only slightly protected by any other devices. The protection of men fighting the quick-firing guns is the problem of the hour for the naval constructor.

Objections to increase of dimensions. It is easy to remedy defects by an increase in tonnage. The type represented by the Imperieuse has always found favour with Russian naval officers, and in 1884 an ironclad cruiser, the Admiral Nachimoff was laid down, in which the Russians believe they have succeeded in avoiding the mistakes so severely criticized in the English vessels. The Russian ship is 18 feet longer, and has 400 tons more displacement than the Imperieuse was intended to have.

Sir Edward Reed. Sir Edward Reed is too competent in his profession to admit that increase of displacement would be the remedy which he would adopt. He first made his high reputation by his success in combining increase in fighting efficiency with a considerable reduction from the unwieldy dimensions of the early ironclads. All the changes in the methods of naval warfare point to the adoption of types of moderate dimensions. It is more than ever important to distribute the awful hazards of battle among many ships, and if we may anticipate that the battles of the future will be decided, like that of Lissa, by the ram, superiority is not less essential in those manœuvring qualities which, *cæteris paribus*, must always be improved as we reduce dimensions.

If we seek to extend belts at the water-line without increase of displacement, we must take armour from other parts of the ships.

We may reduce the thickness of armour on the athwart ship bulk-

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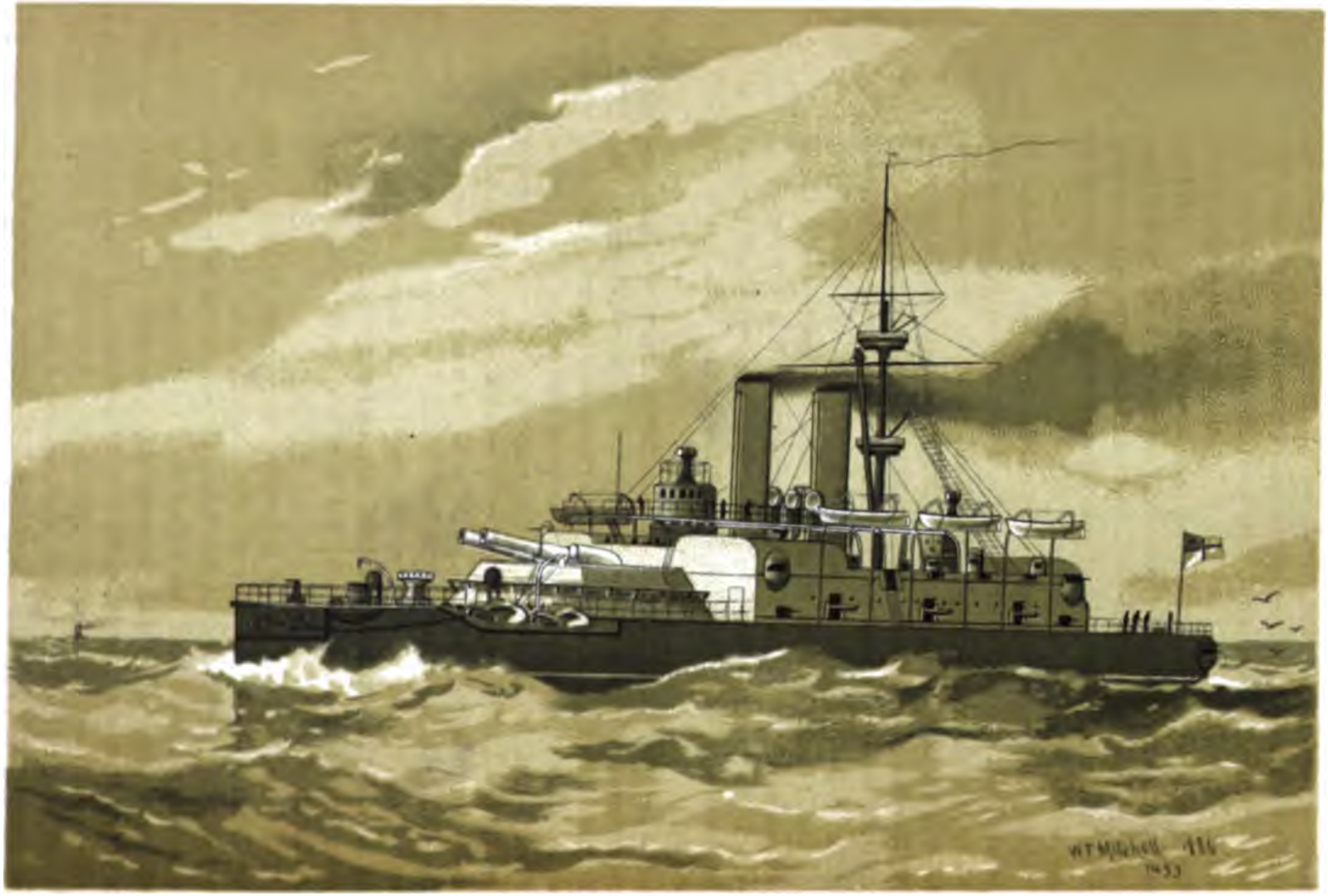

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heads of the citadel ships. Such an expedient would deprive the Admiral class of a protection to which naval officers attach the highest value. In the naval battles of the future, the attack will probably be delivered in the "end on" position. With a narrow belt at the water-line, and without an armoured athwartship bulkhead forward, there would be no protection for the vitals of the ship from a raking fire of explosive shell from the heaviest guns of the enemy at the instant when the attack from the ram was being delivered or parried.

Deck armour

Again, deck armour might be reduced. It should, however, be observed, that the method of protection by thick horizontal plating has of late been universally applied in the designs of the new cruisers for the French Navy. In the Italian Navy, in their largest ships, of 13,250 tons displacement, and armed with 111-ton guns, the gun positions being protected by compound armour-plates 18 inches in thickness, the protection by means of a belt has been entirely given up, and a heavy weight of armour has been appropriated to the protection of the decks and the barbettes. Whether rightly or wrongly, the Italian officers, and the able constructors working under their guidance, rank their large ships in the first class for the line of battle.

Weak points in every type of fighting ship.

Having given not a little thought to this unattractive subject, and endeavoured to approach it with impartial judgment, I arrive at the conclusion that, for a critic so powerful as Sir Edward Reed, it is an easy task to point out vulnerable parts and defects in any vessel of war which human ingenuity can contrive. We can only secure complete protection against the gun by resorting to dimensions practically inadmissible. On the whole it might have been better that the belt of the Imperieuse should have been a few inches higher, and the belt of the Collingwood a few feet longer, the belt gradually tapering towards the extremities, and the increased weight of the belt being taken from the horizontal deck; but there is much to be said against an alteration.

Warning against alterations of ships building.

The main objection to the Imperieuse would seem to be that the ship is too costly for the work she was designed to do. It is difficult to resist the conviction that two belted cruisers would be preferable to one Imperieuse. But the belted cruiser type was not before us when the design for the Imperieuse was approved. The lesson to be learnt from the experience with the Imperieuse and other vessels will probably not be lost on the Admiralty. To all future proposals to add weight after designs have been approved they will offer—and the present Board have made a solemn declaration to this effect—a stubborn resistance. It will not be so easy as the inexperienced may think to adhere to this decision. Gunnery and torpedo officers are steadfast of purpose, and clever and persuasive far beyond ordinary men.

In concluding these remarks on the Imperieuse, an appeal may be made from the arguments of rival constructors to the judgment of seamen. Sea officers, who know the Imperieuse only as she has been described by the pen of an able professional controversialist, should make a personal inspection. The seaman's eye cannot fail to be satisfied with the appearance of the ship as she floats upon the water at the load-line with all weights on board. If it were possible to carry the examination further, and to obtain the opinion of a board of naval officers after a full trial at sea against a succession of winter gales in the Atlantic, alternately in a ship of the Imperieuse type and in a ship of lower free-board, such as the Devastation, or even that more general favourite of the Navy the Dreadnought, a verdict favourable to the Imperieuse might with confidence be anticipated.

Designs should be obtained from professional men outside the Admiralty.

In this connection I offer for consideration a suggestion which informally I laid before individuals among my former colleagues. Might it not be greatly for the public advantage to utilise the admitted high attainments and experience of Sir Edward Reed in another *rôle* than that of a somewhat ruthless critic and untiring assailant of Admiralty designs? When a final decision has been taken as to the type of fighting ship next to be laid down, Sir Edward Reed should be invited to prepare a design, in conformity with the conditions and instructions laid down by the Board for their own constructors. There might, or might not, be important differences of detail, but if the designs differed, it is probable that special features of excellence would be found in each. It is the duty of the Admiralty to utilise for the public service all the available talent in the country, and there are obvious objections to our plan as hitherto pursued, of building all our ships from the designs of the same author. A new departure may be taken with advantage, not only in the contracts for construction, but in the preparation of designs.

Building programme, 1887–88.

Having described the most important ships lately launched in England and abroad, we may turn to the shipbuilding programme of the Admiralty for the current financial year, as given in the First Lord's Memorandum.

The most notable vessels proposed to be laid down in 1887–88 are two 20-knot protected cruisers.

Their dimensions are:—

Length	265 feet.
Breadth	41 „
Displacement	2800 tons.
Speed on measured mile, with 400 tons of coal, and fully equipped	20 knots.
Ocean speed	17 to 18 „
Radius of action at 10-knot speed	8000 „

The vessels will have a protective steel deck extending from stem to stern, and sheltering the boilers, magazines, steering-gear, &c.

Vertical (inverted-cylinder) triple-expansion engines are to be fitted in the steel-bottomed ships, special arrangements of armoured coamings being built for the protection of that portion of the cylinders.

Above the protective steel deck the space will be minutely subdivided, coal-bunkers, cofferdams, &c., being built as is usual in vessels of the "protected" class.

A double-bottom on the cellular principle, adapted for water-ballast, will be fitted.

The armament will include—

6 6-in. B.L.R. guns on centre-pivot mountings.
9 6-pr. rapid-firing guns.
Machine guns.
6 Torpedo tubes (all under cover).

The bow will be strengthened for ramming in the usual manner.

In all respects the vessels will be made suitable for independent sea-service, and for being driven at high speed in rough water.

They will have only fore and aft steadying sails, being dependent upon their steam-power and twin-screws for propulsion.

THREE COPPER-SHEATHED 19¾-KNOT CRUISERS.

It has been decided to vary the design in three of the vessels in the following particulars:—

1. To wood-sheathe and copper the bottoms, so as to make the vessels capable of remaining afloat for long periods without serious fouling and consequent loss of speed.

2. To adopt horizontal engines, placed entirely below the protective deck.

These changes involve an increase in displacement and a slight decrease in maximum speed, which are accepted in view of the special services for which the vessels are intended.

In armament, protection, and all other qualities, the conditions are the same in these as in the steel-bottomed ships.

The trials of these vessels will be made under the new regulations, with all weights aboard.

New ships proposed.

The wise policy of rapid advancement of the numerous ships in hand necessarily precluded the possibility of an ambitious laying down programme in 1887–8. All the new vessels proposed by the Admiralty are valuable in their several classes, and exhibit a distinct advance in the essentials of fighting efficiency. The 20-knot cruiser will have a conspicuous superiority in speed over the numerous cruisers recently purchased for the Russian Navy, and will compare not unfavourably with the French construction of corresponding dimensions. In ships of 3000 tons and under it would be unreasonable to look for the same coal endurance and the same power of keeping up speed in the ocean in blowing weather, which should be secured in our belted cruisers of 5000 tons and in the large unarmoured cruisers building in France. This observation is not intended as a criticism. Vessels of both types are needed in a great service.

The necessity for a considerable addition to the gunboat class, even in the important types represented by the Buzzard and the Rattler, is evidently admitted with regret by Lord George Hamilton. This aspect of the question is reserved for discussion elsewhere. At the present stage it will be sufficient to say of the Rattler and Buzzard that they are decided improvements on the older vessels in point of speed.

Coal supply.

The limited coal supply is the only feature in the new designs which calls for remark. In the following table the vessels designed by Mr. White are compared with those designed by Sir Nathaniel Barnaby:—

—	Speed.	Horse-Power.	Coal Capacity.	Designer.
Rattler	13·5	1200	105	White.
Icarus	12·5	1230	150	Barnaby.
Buzzard	14·50	2000	160	White.
Swallow	13·5	1570	160	Barnaby.

Rate of construction.

Turning from the laying down to the completion of ships, a marked acceleration in the rate of construction has been brought about under the pressure of public opinion. The desire is natural with the naval profession to secure the adoption in every ship of the latest devices and improvements in gunnery and torpedo fittings. Upon

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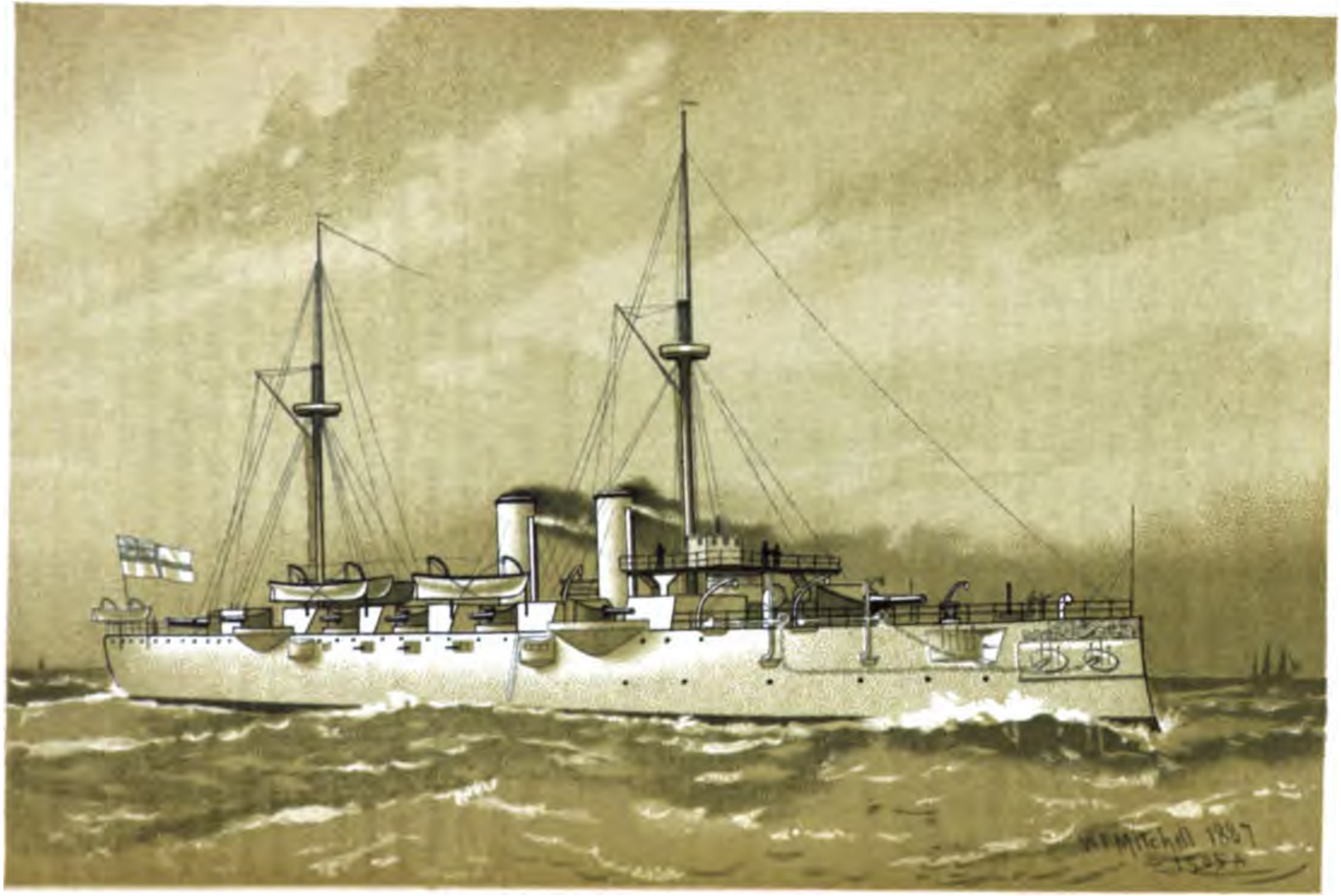

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matters of armament opinion is often divided, and the decisions taken by one officer are reversed by his successor. It is unnecessary to insist on the serious delay in the completion of ships due to demolitions and reconstructions proposed and sanctioned, in the vain hope of reaching an unattainable standard of perfection. In the past it is no exaggeration to say that they have caused delays of three and four years in the completion of particular vessels. It will be the same again, unless the Admiralty stand firm, as the present Board have resolved to do, in refusing to listen to suggestions for alteration after a ship has been commenced. It is not to the ships half finished, but to those about to be laid down, that new ideas in gunnery and torpedoes should be applied.

Ships to be completed, 1887-88.

The list of ships to be completed in the current financial year includes:—

3 armoured ships (Admiral class).
1 Warspite.
1 Hero.
5 belted cruisers.
2 protected vessels.
6 Archer class.
1 Fearless.
3 torpedo gunboats (Rattlesnake class).
3 composite sloops and gunboats (Buzzard and Rattler class).

Of 37 ships building or incomplete at the commencement of 1887–8, it is hoped that 26 will be complete at the end of the year.

Decision to lay down no more armoured battle-ships.

Vindication of policy of Admiralty.

The Admiralty have for the present decided not to lay down any more ironclads of large size. Looking to the new direction which is being given to naval construction abroad, and to the altered conditions of naval warfare generally, this decision should command approval. The only large ironclads* now in hand for the French Navy are the four ships of the Marçeau type. The Germans have no ironclads in hand. It is in Russia and Italy that serious efforts are bestowed on armoured construction. So long as we see in the fleets of foreign powers ironclads possessing those undoubted advantages which armour must give, in protecting the vitals of ships from all but the heaviest projectiles, we must take care to maintain a superiority in vessels of this class over any combination of forces which we may be called upon to meet, whether in the Channel or the Mediterranean. That position of advantage we shall hold when all our ships now in hand are completed, and assuming that no new ships are laid down elsewhere. Having made ourselves strong in the class of heavy battle ships, our shipbuilding policy should not be guided by mere rivalry, and that possibly in a line that does not commend itself as the best calculated to strengthen us in the naval warfare of the future.

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* Of six large ships unfinished, two, the Amiral Baudin and Formidable, are practically complete.

The advantages of armour as a defence against heavy guns, and still more against light guns, is admitted, and its retention must be accepted as a necessity. The problem with which we have to deal is the effective application of armour to ships which shall combine a high degree of fighting efficiency with reasonable dimensions.

Objections to ships of excessive dimensions.

Through all the changes which we can anticipate or conjecture in the methods of naval attack, a decided superiority in numbers must be a preponderating element of advantage in battle. In the essays prepared in competition for the prize offered by the United Service Institution, by the young officers of the Navy, some able observations may be found which may be appropriately quoted.

The following is from an essay by Captain Harris, R.N., on 'Maritime Power and its Probable Application in War,' published in the *United Service Institution Journal* for 1883:—

R. U. S. I. Journal, 1883, p. 418.

"The French Rear-Admiral Aube in his celebrated article on Naval Warfare, says: 'A fleet superior in numbers will be from the commencement of hostilities, mistress of the seas,' and 'the empire of the sea, in the strict meaning which we must give to those words in the present day, belongs to the most numerous ironclad fleet.'

"We need not split too many straws over the individual capabilities of certain vessels. Let us take care that there be no deficiency in numbers of moderately capable vessels all possessed of good speed.

"Can anybody positively state that a force of ten armoured vessels of the very first class, are the equals in a sea-fight of fourteen or fifteen armoured vessels of the second class of the same speed, or that the same ten first-class armoured vessels are the equals of five armoured vessels combined with fifteen or sixteen protected torpedo and gun vessels, all of equal speed.

"Here we have twenty-one ships against ten, all the speeds to be equal; the torpedo power of each vessel the same, and the proportion of ramming power also to be twenty-one to ten. Is it not possible that the superior gun power and armour-plating may be insufficient to counterbalance the disproportion of the other weapons?

"None will question that the Lepanto type with their extreme speed possess an unequalled power in single combat, or question their great strategical power, when attached to a fleet, of bringing to action the sternmost vessels of an enemy who was bent on declining battle; but the possible easy disablement of such costly monsters of the deep by vessels of insignificant size and comparatively trifling cost should make us reflect as to the wisdom of placing too much dependence on, or being content with, a Navy composed of a few such Leviathans."

The arguments for, and the objections to, an increase of displacement were ably summed up by Captain Harris in a later essay:—

Captain Harris, R.N.

"The naval architect of to-day, who would design a perfect battle-ship, must secure good speed combined with manœuvring power and coal carrying capacity. He must protect the machinery and vital parts with armour of immense thickness. The armament must be formidable. The ship must be capable of being used as a powerful ram, and she must be seaworthy, have a thoroughly steady gun platform, and be commodious for officers and men. Suppose that all the necessary but conflicting conditions have been well balanced, it will always be found that a larger vessel could be built which could be more powerful. On the other hand, do not the necessities of modern naval warfare forbid that we should throw our whole constructive strength into the creation of the biggest possible ships, each being equally liable to fall a victim to the torpedo?"

M. Gabriel Charmes.

It is understood that the late M. Gabriel Charmes was the authorized exponent of the views of Admiral Aube. The following passages are taken from his work 'La Reforme de la Marine':—

"It would be a wise policy in shipbuilding, for the purposes of war, to put aside the complicated ironclad built to perform several functions, costly, yet possessing but limited speed, and to build a large number of special vessels, gunboats and cruisers, all designed to use with the greatest effect one weapon only, and all having the greatest possible speed. In pursuing such a policy we shall improve results and reduce expenditure."

Lieutenant Semechkin.

M. Gabriel Charmes supports his views by numerous extracts from the writings of officers of other navies. He quotes the opinions of Russian officers. The tactical exercises of their fleet in the Baltic, under Admiral Boutakov, have been conducted with marked ability. In his lectures on tactics, Lieutenant Semechkin, *aide-de-camp* to Admiral Boutakov, in describing the impressions derived from recent experiences, insists again and again that the nation which has the advantage of numbers will be certain to win.

In a later publication, 'Les Torpilleurs Autonomes,' M. Charmes quotes Admiral Porter and Admiral San Bon.

Writing to his Government in 1873, Admiral Porter said: "I am

Admiral Porter, U.S.N.

convinced that the torpedo, although still in its infancy, is destined to hold a great place in future maritime war. England is making great progress in the use of this weapon, which is capable of destroying the stoutest ship."

Admiral San Bon.

In 1875, Admiral San Bon, who had advised the policy of constructing the large ironclads of Italy, spoke as follows in the Chamber of Deputies:—"As to laying down to-day nothing but ironclads, I dare not do it. I maintain that a squadron of armoured vessels must certainly be beaten by three or four torpedo rams of the kind which I should wish to construct. In the present condition of the Navy, against the armourclads actually in existence, which are all extremely vulnerable below the water-line, the torpedo is the most formidable of weapons."

Italian naval policy.

It is difficult to approve the extreme developments of tonnage in Italy. Ships were first increased in size in order to carry armour. It could not have been anticipated that the growth of tonnage would continue after armour had been discarded for the general protection of ships.

The Italian Naval Administrators vindicate their policy of construction on the ground that it was impossible to build ship for ship against France. It was possible to build a few ships surpassing any ship in the French Navy in speed and armament, which could accept or refuse a challenge to battle from the French fleet, and any one of which could easily destroy a fleet of transports. It was not possible to defend Italy from invasion by fortifications. It was possible to defend the country by only a few ships of the first class. Other considerations than these will guide the decision of the British Admiralty.

General conclusions.

These extracts might be multiplied without limit. The opinions of naval officers and the naval construction in France and Germany and the United States give no support to the policy of building ships of such dimensions as must invite attack with the ram, which the big ship from her very hugeness can use with the least effect, and will find it most difficult to parry. The ram, whether in the form of the solid beak or the torpedo fired from and acting as a prolongation of the ram, is the weapon destined in the opinion of many to decide the battles of the future, and we shall scarcely do wisely if we lavish money on ships particularly exposed to its attack. While the objections to a great advance in dimensions have been fully recognised by administrators and constructors alike, it has thus far been found impracticable to place any limitation on displacement in the shipbuilding for the British Navy. Sir Nathaniel Barnaby has described how the French Caiman, of 7000 tons, grew into our Collingwood of nearly 10,000 tons. The same history was repeated in the advance from the Conqueror to the Sans Pareil. It was admitted to be highly desirable to give to the Navy repeats of the Conqueror, with a less cumbrous superstructure, an effective minor armament, and an 18-ton gun protected by a half turret in the stern. Such a vessel should have been built at a cost which would have given us for the same aggregate expenditure two improved Conquerors, as against one Victoria or Sans Pareil. When, however, the design for the new ships was seriously considered, the same elements of fighting efficiency were insisted upon, as in the case of a battle-ship of the first class. The Conqueror type as reproduced, to meet all the new conditions, as to thickness of armour, and calibre of armament, was increased from 6200 to 10,470 tons, and the cost was doubled. The elements of fighting efficiency may be tabulated as under:—

Elements of Fighting Efficiency.	Conqueror Type.	Sans Pareil Type.
Distribution of Risk.	Two Ships.	One Ship.
Speed	15·5 knots	16·75 knots
Rams	Two	One
Armament . . .	Four 44-ton	Two 110-ton
	Two 29-ton	One 29-ton
	Eight 6-in. 5-ton	Twelve 6-in
	Twenty-eight machine guns	Twenty-four machine guns
Armour	12 inches	16 inches
Torpedo launching-tubes	10 tubes	5 tubes
Captains . . .	2 captains	1 captain

The relative strength will be measured differently, according to the individual judgment of officers. Some would certainly prefer two Conquerors. It is not urged that no big ships should be built. It is a matter of regret that we are building no armoured battle-ships under 10,000 tons, or costing less than £750,000.

Calibre of guns.

The argument as to ships might be extended to the guns. Looking to the uncertainty of aim, and the slowness of fire, the importance of numbers is at least as great in the case of the guns as in the case of the ships. The 43-ton gun will penetrate 21 inches of wrought iron at a thousand yards. Few are the ships which carry armour of that thickness, and small is the area so protected even in the most heavily armoured ships. If the 43-ton gun is sufficiently powerful for all practical purposes, would it not be wise to get rid of further risk of complication, by resting content with guns of a calibre which have been found by experience to be of manageable size?

Naval battles will be fought at close quarters.

In the spirit of rivalry, raised to the highest point by competitive fire at a target, we may be betrayed into exaggeration of dimensions, and guns may be manufactured but ill adapted for the far different ordeal to which they would be subjected in close action afloat. Vast as is the change since the days of Nelson, yet in the din and smoke and confusion of battle, the old method of fighting may still be found the surest means of victory. In the fourth volume of his despatches we have the experiences of Lord Nelson:—"As for the plan for pointing a gun truer than we do at present, I shall of course look at it; . . . . but I hope we shall as usual be able to get so close to our enemies that our shot cannot miss their object."

Mr. White.

The arguments for moderate calibres were summed up so clearly and forcibly by Mr. White in his lecture delivered at the Mansion House on "Modern War Ships," that while affecting neutrality he may almost be recognised as an authority on the side which it is sought to recommend:—"There are not wanting advocates of the view that the risks of failure incidental to these mechanical appliances are too serious to be accepted, and that guns have outgrown the necessities of the naval service. They point to the comparatively long time occupied in loading a very heavy gun, to the unavoidable uncertainty of naval gunnery, and to the enormous value of a single discharge, which may mean a 'miss.' They consider that for the naval service a much greater number of light guns would be preferable because of the increased number of the discharges possible in a given time, and the consequent increase in the number of hits. They draw attention to the fact that comparatively light guns of long range and great accuracy which can be worked by hand, are capable of perforating most of the armour carried by war-ships at the range which is considered a fair fighting distance; and that on the large unarmoured areas of most armoured ships the shell fire of lighter guns (including quick-firing and machine guns) would be effective. On the other side of the debate it is urged that in active service so many circumstances make against the effectiveness of gun fire that a large margin of power is desirable: that a single successful shot or shell from the heavier guns would produce enormous damage; and that the association of a powerful secondary armament with the heavier guns fully meets the case. Having stated both sides, I leave the matter; only adding that in the latest ships, both English and foreign, while heavy guns are to be carried, they are not the *heaviest* available."

Committee on warlike stores.

The observations of the committee on the purchase of warlike stores are certainly not in favour of monster ordnance. They quote Lord Armstrong on the treacherous nature of steel generally. "Steel was a very treacherous material, but he could place perfect confidence in coiled iron. With steel the calculated strength was not realised. There are tensions within the body of the material that are opposing each other, and any disturbance of those give the preponderance to the one or the other, and the thing breaks. That is far more liable to happen in a large mass than in a small one." The Commission refers to the observations of Sir Frederick Bramwell as to the possibilities of a local defect in the case of the gun which burst on the Collingwood. Sir Frederick Bramwell had said that steel was of such a nature that fractures occasionally take place which can be referred to no possible cause. Commenting on these observations, they say:—"This if correct is a great misfortune. It shows that large guns must at present be regarded as being to a greater or less extent experimental and speculative; but it is a misfortune from which all nations must suffer equally. We have reason to think that failures of a very serious character have occurred in both French and German guns, of which, however, little is allowed to be known."

The Commissioners further point to the limited durability of the 110-ton guns. The charge of powder and projectile weighing nearly a ton costs about £150. The gun itself costs about £20,000. After firing 150 rounds it will require relining with a new steel tube. This would render necessary its removal to Woolwich, where the operation would occupy a considerable time and would cost a large sum of money. "It seems to us that the result in this case is hardly equal to the expenditure, and that it is unfortunate if nothing better than this can be devised."

German opinion.

German opinion on the same subject is quoted with strong approval by M. Gabriel Charmes in his 'Reforme de la Marine.' "Most certainly," said the *Marineverordnungsblatt* of the 15th of November, 1883, "the power of a monster gun is to be feared. Yet would not a less powerful projectile suffice to disable an enemy? At sea, the chances in favour of a successful shot are very slight; because both the object aimed at and the ship itself are moving. A gun of a lesser calibre is much handier to work and gives a greater accuracy in firing. In the case of a miss the loss is not so great as with a projectile of 10, 15 or 20 cwt., from a gun of 50, 75 or 100 tons. Guns are exposed to the enemy's fire, and a hit on the muzzle would render any gun unserviceable. Several pieces of smaller ordnance, concentrated on a gun in a turret would in a short time silence it. Would it not be possible with a small ship, armed with three or four light guns which had its vital parts protected by armour, to successfully attack the stern of the Inflexible or Italia, and by rapid fire to wreck and destroy their unarmoured ends? No; we want no more monster guns for our fine and powerful ships. We must adopt ordnance easier to move and easier to serve; monster guns offer too large a target for the enemy's fire."

ARMOURED TORPEDO RAM.

Shipbuilding policy.—Ships should be adapted to the effective use of the weapon.

Torpedo ram.

Accepting the limitation of dimensions as a condition which must govern the construction of fighting ships, our designs can only be made successful by abandoning the attempt to combine in any single vessel, and in the most effective form, the use of the gun, the ram, and the torpedo. We must separate these weapons, adapting one type or class of ships specially to the torpedo, and another to the use of the ram. This brings us to the type represented by the Polyphemus for the torpedo ram, and to the armoured gun vessel for the gun.

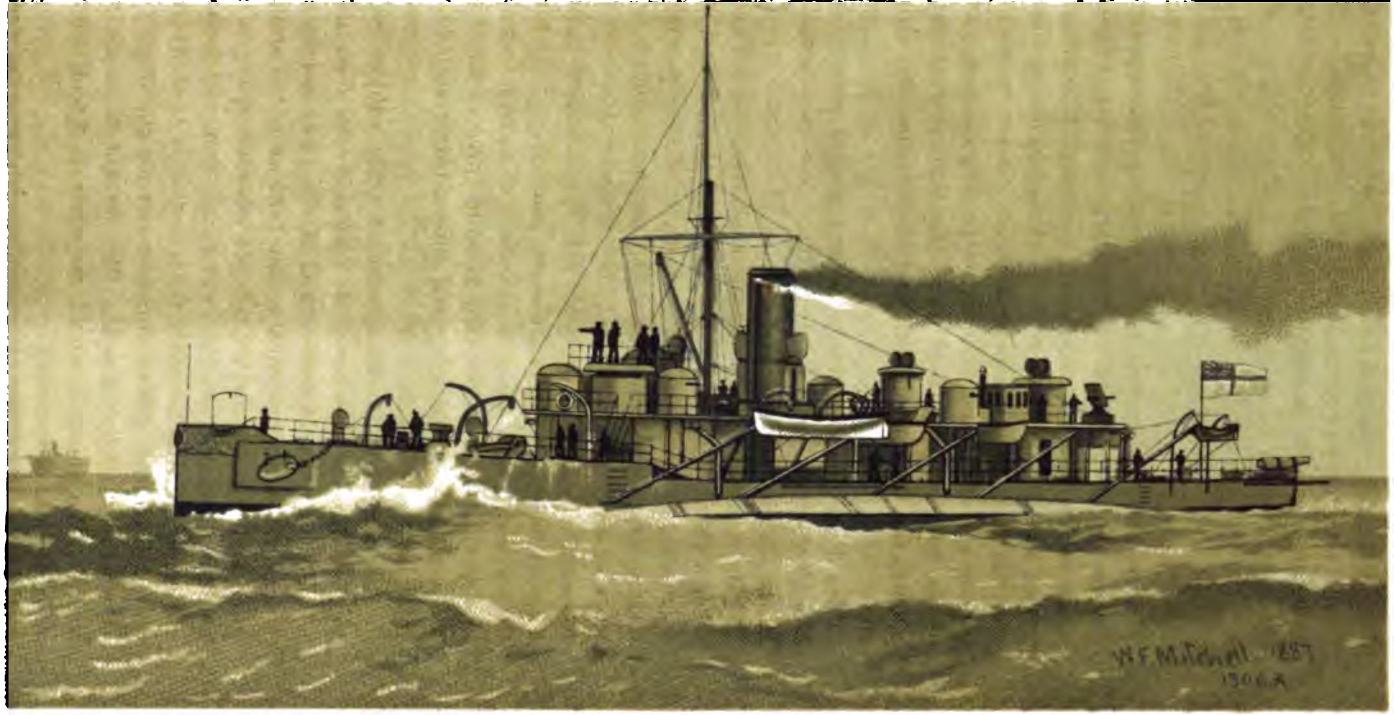
Naval opinion both at home and abroad points distinctly in the direction which we are suggesting. We may again quote Captain Harris, in his essay on 'The Defence of England':—

"The armoured vessels to command the Channel need not possess all the qualities we demand in ships intended for a wider sphere of operation. We may accept a limited coal supply, and as they would not be required to undertake the bombardment of an enemy's forts, we may accept the fact that the gun would not be their principal weapon. An armoured torpedo ram would appear to be the type best adapted for the duty; and the comparatively small tonnage required for a vessel of this class would allow of a great increase in number, and would render it possible to build three or four torpedo rams for the cost of a single armoured line-of-battle ship of the first class intended for operations abroad."

The same lucid writer returns to this subject in his last essay published in the *Journal of the United Service Institution*:—

"If we build a barbette vessel of the same weight as the Benbow, with its 10,000 tons displacement, take away the armament of heavy guns and fit tubes for Whiteheads wherever it is possible to put one, confining the armour to the water-line, belt, and tower, and giving a sea-going speed of 20 knots, the question is resolved into this: Which ship will be first able to sink or water-log the other? The question is worthy of deep thought. We do not advocate such a torpedo vessel. We think it would be wiser to spend the money in the construction of two ships."

No navy of modern days has had such experience of naval warfare



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H.M.S "POLYPHEMUS."

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under the new conditions of heavy guns, rams, torpedoes, and armour, as that of the United States. Their opinions, delivered under the influence of recent impressions of a great struggle, should command attention. Of the American authorities whose recommendations were originally collected in *The British Navy*, the Secretary of the United States Navy, in his report for 1876, shall be the first contributor to a short list of quotations.

Secretary U.S.N. Report, 1876.

"The Monitor class of vessels has, for us, special and valuable capabilities in conjunction with other forces. The torpedo schools give our officers the instruction necessary to utilize whatever there is in this most efficient arm of attack and defence; and I would add to the force a new element, the marine ram, which promises, when constructed upon scientific principles in forms of special strength for its particular and appropriate service, to be a weapon of most destructive warfare. The construction of this class of vessels has been carefully considered for several years past by a naval officer of high rank, assisted by able experts, and detailed plans are put at the service of the department without cost or charge of any kind. The construction of such a vessel, of the best material and of special strength, would involve an expense of about $350,000, and if successful, as it promises to be, it would add a new element, tending to make our force complete in itself, at once economical and efficient.

"With such a force, and with no colonies to defend, I think we may well dispense, for the present at least, with the heavy and unwieldy ironclads of European nations, and also with the monster cannon necessary to penetrate them. Any vessel which can safely cross the seas to enter our harbours, or to lie upon our shores, will be found vulnerable to cannon of moderate weight and calibre, while the heaviest armour will not protect a ship from the attacks of torpedoes managed by brave and well-instructed officers."

The next quotation is from a later report, by the Bureau of Construction and Repair.

Bureau of Construction and Repair, U.S.N., 1878-79.

"The service requires fast, unarmoured, cruising ships, and also one or more powerful rams. With very fast ships we can destroy the commerce of an enemy, and be on equal terms with his ships of like character; while in the event of meeting with powerful, but comparatively slow armoured ships, we could leave them at pleasure. Believing that Congress would not long delay the appropriations needed for vessels of this character, directions have been given to have plans prepared by naval constructors having work in charge, for unarmoured cruising vessels of 3500 tons displacement, and iron rams of 2000 tons displacement."

Turning to the recommendations of individual officers, Rear-Admiral Goldsborough, U.S.N., has put forward the capabilities of the armoured ram in a convincing argument.

Rear-Admiral Goldsborough, U.S.N.

"Notwithstanding all that has been done, and the enormous expenditures incurred to secure an invulnerable hull *throughout*, and to guard at the same time against too great a sacrifice of sea qualities and other essential attributes, but at least an indifferent success has been reached in any quarter, and this has already induced some respectable minds abroad, if not among ourselves, to despair of accomplishing much more. The efficiency or intrinsic worth of an ironclad intended for the ocean or for coast purposes, is to be estimated according to her strength throughout *every part* of the hull, her sea qualities, the distribution and character of her battery, and the ability of its use in all cases of fighting weather, the efficiency of height of her deck above the water to resist the vaulting effects of a spoon-bowed opponent, the substantive protection afforded by her plating; her capacity to move rapidly and turn quickly; her space for requisite accommodations, and (pardon the word) her habitability. . . .

"It is very clear that no vessel confined to rational dimensions can support, throughout her exposed parts, more than a very limited thickness of iron plating. . . .

"A hull arranged after this fashion with turret for the battery, is, I conceive, about all that can be done in the way of plating with iron, consistently with all the considerations involved, and even this would be of but poor account unless the other elements of efficiency mentioned above were duly secured.

"Among those elements is that of celerity in turning, and as it is a point to which sufficient attention has not been given hitherto, I wish to impress my convictions in regard to it.

"Every ironclad, as a matter of course, should be an unexceptionable ram. This, however, cannot be the case unless she can be directed with a great degree of promptness to any desired quarter, or turned with every degree of quickness necessary. But celerity in turning is not to be estimated only in the advantage it gives in offensive movements, for it is also of the greatest consequence in defensive operations, and, as an instance, it confers the power to parry, generally, the intended blow of an antagonist ram, if not to avoid it altogether.

"Velocity, involving as it does the capacity of prompt presentation wherever required, of making in effect the vessel herself a terrific projectile, of turning rapidly, and of avoiding hostile demonstrations whenever necessary, is of such primary importance that an insufficiency is to be regarded as fatal to efficiency. . . .

"A marked pause must occur in the progress of ordnance before a fixed or definite conclusion can be reached as to the relative immunity obtained by iron plates. Absolute immunity is out of the question.

"The progress of ordnance has already produced the effect of restricting the application of armour in the case of sea-going vessels to the more vitally exposed parts; and it is quite possible that it may finally establish conviction that such plating, for such vessels, is really of no marked consequence. In the mean time the tendency of its effects must be to impress the value of rams, thus reviving a mode of naval warfare which on a miniature scale existed long before the invention of gunpowder.

"The value of rams at this very moment cannot be over estimated. With a few of them in each of our prominent commercial ports, none scarcely of more than half the displacement or weight of the 'Dictator,' no enemy, I care not how powerful, could blockade those ports successfully; for, possessing the great advantage of biding and selecting their own time, they could so manage the delivery of their blows as to annihilate his vessels. Nor could those ports, in my judgment, be assailed successfully. The protection of harbours nowadays does not lie in forts. It lies essentially in powerful steam rams, aided when necessary by obstruction in passage ways.

"Rams, intended purely for harbour defence, would be better without than with guns. They themselves are to be the projectiles; or, if you please, they are to be the shot, and the steam is to be the powder; and the effect of both, properly combined, would be absolutely irresistible. Besides, to fit the rams for guns would be to swell the item of cost largely, and thus abridge their multiplication. The essential points to be secured in these rams, each to a degree as consistently with all the rest as practicable, are great strength throughout every part of the hull, not overlooking the bottom by any manner of means, every protection that supportable plating can afford; a high velocity, an ample security of machinery, the utmost rapidity in turning and a suitable bow."

Rear-Admiral Ammen, U.S.N., is another able advocate of the armoured steam ram.

Rear-Admiral Ammen, U.S.N.

"I venture the opinion that the time is not distant when the marine ram will take the place of the enormously expensive armour-plated gun-bearing ships of to-day. . . .

"I believe much the larger part of the educated Navy men of all grades are in accord to divide our naval vessels into two general classes, one for coast defence, the other for cruising abroad and serving as schools of instruction for officers and crew. . . .

"For coast defence, it was assumed that our reliance should be upon marine rams, torpedo-boats, and floating batteries.

"The marine ram, however, should be regarded as the principal element on which dependence is to be placed, and in order to meet requirements should have speed and the power of maintaining it for twenty hours at least, handiness, great strength of construction, and a practical invulnerability to shot. . . .

"The ease with which expensive armour-plated gun-bearing vessels have sunk, when endeavouring to avoid each other, suggests the havoc which a fleet of properly constructed rams would make in a fleet of armour-plated vessels.

"Considerations of both economy and efficiency point to the marine ram as the main element in the solution of the problem of coast defence."

Type proposed by Rear-Admiral Ammen.

As to the type which should be built for the ram and torpedo, Admiral Ammen proposes a ram of 1500 tons, and manned with a crew of 16 men.

The armoured ram has been strongly recommended by French authorities. The six vessels—three Bélier type, three Vengeur type—classified in the French lists as armoured coast-defence vessels, were designed for service as rams. The addition of a pair of heavy guns has destroyed that unity of purpose and simplicity and cheapness of construction, on which Admiral Goldsborough in his admirable paper particularly enlarged.

Type—M. Gougeard.

Passing to more recent projects the following outline of a design from M. Gougeard is quoted in *Engineering*, February 25, 1887:—"Construct a veritable sea-going vessel possessing nautical qualities in the same degree as our best ships. Her principal weapon should be the torpedo. She should be so built that the artillery up to and comprising 10-in. guns, fired under probable conditions, cannot seriously damage her. Give her a speed equal, or even superior, to that which has been obtained in the trials of torpedo boats (French) Nos. 63 and 64." In other words, "ships that will have for characteristics great speed, steel deck protection and a floatability obtained by means of cells filled with buoyant material. Increase, if possible, their cellular system, and seek within the limits of the weight at your disposal the maximum resistance to the torpedo."

Polyphemus simplified.

The Polyphemus is a type generally approved in the Navy, and susceptible of improvement in future designs. Repeats of the Polyphemus could be built at far less cost than the first experimental vessel, and the protection by armour could be considerably strengthened. The egg-shell Whitworth armour was thin and very costly. It would be desirable to increase the thickness and to use plates of a less expensive description. The removable ballast is a complicated arrangement, which perhaps need not re-appear in future vessels. The weight saved might be given to armour. The superstructure of the Polyphemus is cumbersome; the sides of the ship should be carried up to the height necessary to give accommodation for the crew, the upper works being cut off from the vitals of the ship by an armoured horizontal deck.

In concluding this section we venture confidently to recommend that armoured torpedo rams should have a place in the next shipbuilding programme of the Admiralty. They should be built in numbers sufficient to be fought in groups. With equality or superiority of speed, and an immense advantage in turning power, their machinery, rudder and conning tower protected by stout armour, armed with the quick-firing gun, the torpedo and ram, the success of a determined and skilful attack by four rams costing each £250,000 upon a battle-ship, costing £1,000,000, or four rams each costing £200,000 against a battle-ship costing £800,000 is hardly doubtful.

The big ships have their value. We possess many; the torpedo ram is represented in the British Navy by the solitary Polyphemus.

Armoured gunboats.

Passing from the ram to the armoured gunboat, vessels of this type may be equally valuable, whether in the offensive defence of our coasts and the Channel, or for an attack on the fortified ports and positions of an enemy.

Required for coast service.

For operations on the coast their moderate draught would make them far more effective than the heavy ships on which our efforts in shipbuilding in England have for many years been concentrated. The value of floating batteries for purposes of coast defence were ably summarised in a paper prepared by Commander Sampson, of the United States Navy, for the Board of Fortifications. "For the efficient defence of a coast it is important to be able to act offensively. To be powerless to follow up the effect of a repulse by fortifications might permit an enemy to renew the attack, or to withdraw when they might have been destroyed. If, during an attack, an enemy's ship takes the ground or is disabled, it may be destroyed by floating batteries. A foe will attack a fortified position with confidence, if they know that they have only to withdraw in case they are worsted. A hostile fleet, having to deal with stationary defences only, may concentrate itself upon one point, or divide and attack several points,

Value of armoured vessels for harbour defence—Commander Sampson, U.S.N.

and can attack by day or night. If the stationary defences are supplemented by floating batteries and torpedo boats, the enemy must be much more circumspect; a night attack becomes hazardous in the extreme; he must at all times have assembled a force superior to that which may at any moment emerge from the port to attack him. Floating defences force an enemy to make more extensive preparations for a given attack, and impose greatly increased caution. This may be considered the passive influence of floating defences. The Navy proper should not be appropriated for coast defence. Ships adapted to keep the seas are not suited to the work of defending a coast. The vessels intended for the defence of harbours should be specially designed for the service. Such ships may with advantage be employed in the following cases:—

I. Where the proximity to deep water of the place to be defended renders it impossible to make a proper defence by batteries on shore.

II. Where the great width of the approaches to the place to be defended renders it impracticable to reach all points of such approach with efficient fire from guns on shore.

III. In places where, from the nature of the ground, it is impracticable to mount heavy guns in forts.

Sir George Elliot.

In our own country, the efficiency of armoured coast-defence vessels for preventing hostile ships from bombarding our arsenals has recently been urged by Sir George Elliot. The armoured gunboat is the type which he recommends:—"The efficiency of the modern gunboat will be correlative with the power of the gun which is brought into action, and the amount of protection which is afforded. These properties can only be obtained on the principle of *end-on*, or bow attack and defence, which position must always be preserved, whether advancing or retiring within range of gun-fire. It is also important that these vessels should be able to pass over floating obstructions, or touch the ground in shoal waters, without risk of damaging the propeller. The advantages of hydraulic propulsion are most conspicuous for these purposes."

Value of armoured gunboats for defence of most important commercial harbours of Great Britain.

To those familiar with British hydrography, the suitability of the armoured gun-vessel for coast defences will commend itself with especial force. Our great commercial ports are approached by confined and tortuous channels between banks of sand and mud. This is so in the case of the Thames, the Humber, the Mersey, the Bristol Channel. In narrow and shoal waters of difficult navigation, the type we are advocating would be able to attack an enemy from positions inaccessible to his heavy ships. In bombardments the end-on position has the advantage of offering a small target. If struck on the bow, the armoured gunboat would have protection equal to the heaviest battle-ship.

No coast-service ironclads built for British Navy since 1872.

In the construction of ships for the British Navy, coast-service ironclads have been neglected of recent years. None have been built subsequently to the four vessels of the Gorgon class ordered in 1872. None of our more recent ships can be taken through the Suez Canal. In foreign navies coast-service vessels have received more attention than with us.

Construction in progress in France. First-class gunboats.

The French have, built and building, four armoured gunboats of the first class, the Acheron, the Cocyte, the Phlégéton, and the Styx. Their principal dimensions are as follows:—Displacement, 1640 tons; length, 181 feet; beam, 40 feet 4 inches; depth of hold, 11 feet 7 inches. The bow-armour is 8 inches. The deck is armoured. The machinery, driving double screws, is calculated to give a speed of 13 knots. The armament consists of one 10½-inch gun placed in a turret, and two quick-firing and four machine guns.

Second-class gunboats.

The armoured gunboat of the second class recently produced for the French Navy is described as follows in the *Broad Arrow*:—

"The Mitraille, the third of a new type of ironclad gunboat adopted for the French Navy, was recently launched at Rochefort. Her dimensions are:—Length, 50·30 metres (165 feet); breadth of beam, 9·94 metres (32⅝ feet); depth of hold, 3·15 metres (10⅓ feet). The vessel is provided with armour of a maximum thickness of nearly 10 inches, whilst her deck is also protected by armour against a plunging fire. Her two engines have an aggregate power of 1500 horses (indicated), working twin screws, which will propel her, it is expected, at a speed of 13 knots. The Mitraille is to be armed with a 27-centimetre (10½-inch) gun, placed in a turret forward, as well as with a 90-millimetre (3½-inch) gun, revolving guns, and torpedo-launching apparatus. The other vessels of the same class are La Fusée and La Flamme (previously launched), and La Grenade and four others (building)."

Germany.

The construction of armoured gunboats in France was probably prompted by the building of a similar type for the German Navy. Between 1876 and 1880 eleven armoured gunboats were built of the Wespe type. Their displacement is 1100 tons. They are armed with one 12-inch 35-ton gun, and protected with 8-inch armour on the citadel and turret. Two smaller vessels, the Bremse and the Brummer, are now under construction.

It is possible that neither the German nor the French armoured gunboats would be adapted for the requirements of the British Navy.

Our defence should be essentially an offensive defence. The type we should require must be capable of making a passage to the Baltic or the Mediterranean, or even to China. It may probably be necessary to accept an addition to the displacement, in order to give our armoured gunboats sturdier sea-going qualities and more coal endurance. Such a modification would not involve a departure from the primary idea of a special type, armed with a gun of heavy calibre, protected with armour in the end-on position.

Auxiliaries to battle-ships—Torpedo hunters and videttes.

To complete a fleet for battle all naval authorities concur that the large ships should be supported by a cloud of auxiliaries. To quote once more from Captain Harris :—

"The construction of torpedo hunters and scouts must form an important item in all naval estimates of the future. Fast vessels of light draught, fair sea-going qualities, and armed with quick-firing guns, will not alone prove of the greatest value in destroying the torpedo boats of an enemy, but they will also prove themselves valuable allies to ironclads even in line of battle. Such vessels should have a speed of 18 knots, and a tonnage displacement of 400 to 600 tons."

Torpedo boats too small to cruise with fleets.

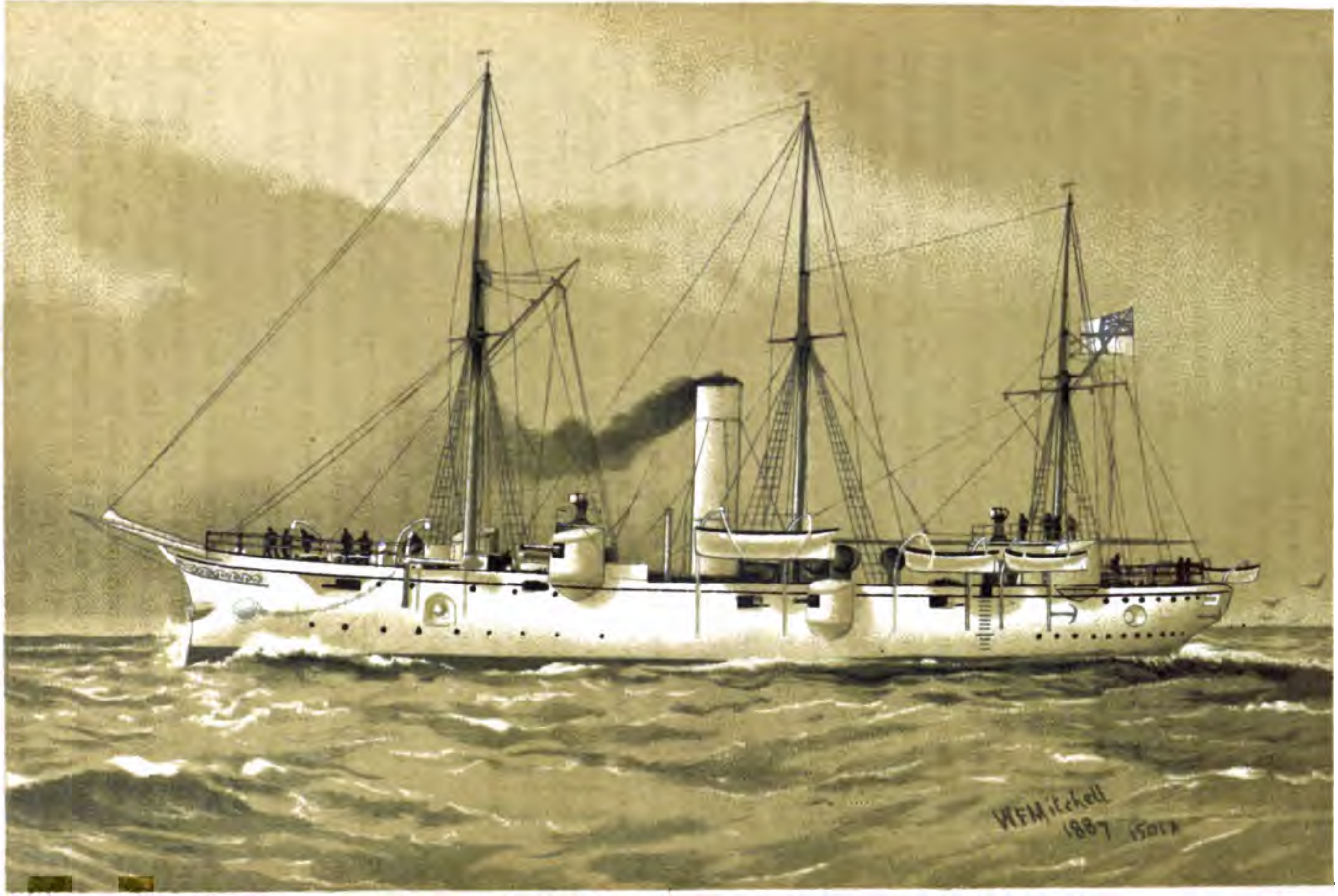
The necessity for the liberal dimensions proposed by the naval essayist for torpedo vessels, designed to co-operate with battle-ships, has been conclusively established by recent experience. Having accompanied the fleet under Admiral Hornby during the interesting evolutions on the coast of Ireland in 1885, I can speak as an eye witness of the impracticability of keeping the seas, in company with a fleet of powerful vessels, in the fragile craft designed only for harbour defence.

Trials of torpedo boats with French Mediterranean squadron.

In the French Navy, under the direction of Admiral Aube, the torpedo boat has been thoroughly tried at sea. It has been established by these experiments that the boats hitherto supplied to the French Navy cannot be relied upon for naval operations in open waters, not even for the Mediterranean. The opinion of the majority of the officers, who served in the French squadron, to which the torpedo boats were attached, is summed up in the columns of *Le Yacht* as follows :—

Article by M. Weyl in *Le Yacht.*

"We do not seek to draw aside the veil in which the future is enshrouded, but it may be affirmed at the present hour that there is more reason to fear the gun than the torpedo boat. The former retains its power undiminished, and its blows cannot be resisted by steel plates; the latter may, it is true, increase its power of attack, but the boat, which has the torpedo for its sole weapon, can only be made seaworthy by raising its tonnage, and thus losing the advantage of



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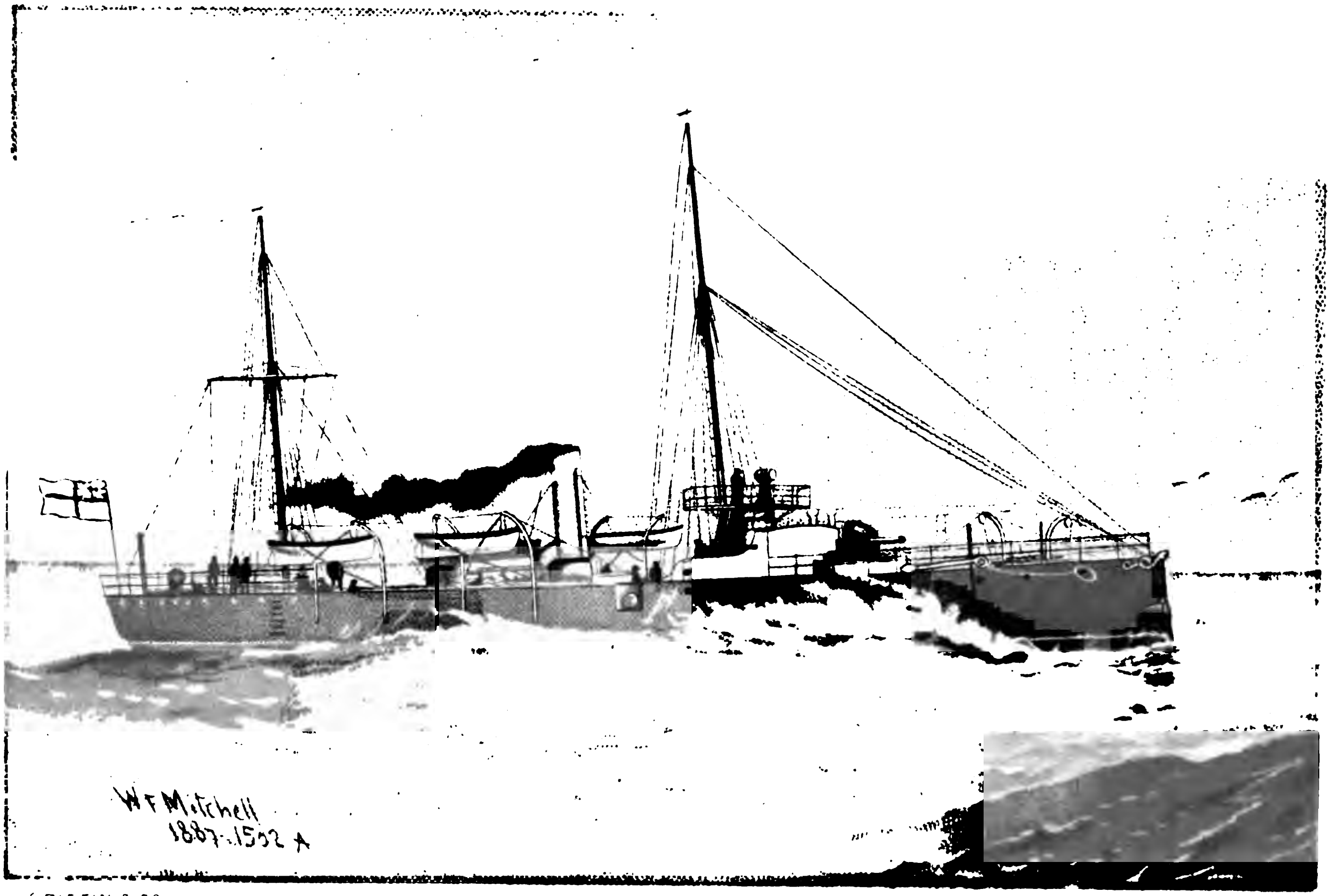

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H.M.S. RATTLESNAKE.

invisibility. The torpedo boat of the future will be protected, we may rest assured, against the quick-firing and Hotchkiss guns, with which the sides of modern vessels of war are bristling, and it can only be protected by means of armour."

Torpedo vessels for United States.

For the United States Admiral Porter recommends torpedo vessels of the Stiletto type, 150 feet in length, with a speed of 30 knots, and fitted with Herreschoff boilers.

Archer type.

Appreciating the necessity for vessels of greater power than can be obtained in mere torpedo boats, Lord Northbrook's board laid down the eight vessels of the Archer type. To the Archer class should be added the Alacrity and Surprise, which, though employed in peace as despatch boats, would become in war effective torpedo vessels. It may fairly be claimed that the Archers are a success. The Archer steamed 18·2 knots by log with a heavy sea running, her performance as a sea boat being proved to be excellent. The coal endurance of the Archers is 7000 knots at 10 knots, and about 2500 knots at full speed. The Archers have an effective light armament, are well armed with the torpedo, and would be most useful to the fleet as look-outs and despatch vessels.

French Condor type.

The Scout type was anticipated in the French Navy by the Condor and three sister vessels. The torpedo cruiser Faucon, one of the four Condors, was lately launched at Toulon. She was built from the designs of M. de Bussy. She is of steel and designed to act both as a look-out ship and torpedo boat-catcher. The principal dimensions are:—Length 216½ feet, beam 29½ feet, depth 12 feet 6 inches, draught of water 15 feet 5 inches, displacement 1280 tons. The hull is protected with a steel deck extending from end to end of the ship. This deck is a little below the water-line, and gives protection to the vitals, engines, boilers, steering apparatus, &c. The hull is divided into ten water-tight compartments by longitudinal and transverse bulkheads carried up to the armoured deck. The Faucon will be armed with five 4-inch guns, five torpedo launching tubes, and six Hotchkiss guns. The Faucon will not be dependent on canvas, but will have three signalling masts carrying Hotchkiss guns, and fitted with steadying sails. The machinery, which will be of 3200 indicated horse-power, will consist of compound engines with twin screws. A speed of 17 knots with forced draught is anticipated.

Rattlesnake type.

The Rattlesnake type, laid down under the present Admiralty, is the smallest type in which it is reasonable to look for reliable sea-keeping qualities. Trial at sea will show whether these boats are sufficiently powerful to accompany a fleet for lengthened periods and in all weathers. If the necessity is established, an increase of size must be accepted. Meanwhile the five Rattlesnakes are certain to be valuable. They have realised the exceptional speed of 18·779 knots.

French—Bombe type.

The torpedo hunter of the Rattlesnake type is represented in the French Navy by the eight vessels of the Bombe class:—

—	Displacement.	Length.	Beam.
		Feet.	Feet.
Rattlesnake . . .	450	200	23
Bombe . . .	320	197	21½

Russian—Lieutenant Ilyen.

The commencement of a similar type has been made in Russia, where the torpedo cruiser Lieut. Ilyen was recently launched:—Length 230 feet, breadth 24 feet, speed 20 knots.

Italian vessels.

The Italians have adopted a type intermediate between the Archer and the Rattlesnake. Two of these vessels are completing, two are in progress but not yet launched, and four additional vessels are proposed. Their displacement is 740 tons, speed 18 knots, and their armament 11 machine guns.

It is certain that the British fleet should be strengthened in the torpedo arm, and that harbour defence torpedo boats cannot keep the sea with a squadron. The unsettled question of the lowest limit of dimensions must be solved by thorough comparative trials of the Archer and Rattlesnake, in all conditions of weather. No time should be lost in fitting out a vessel of each type for experimental cruises in the chops of the channel.

Torpedo-boats. possessed by maritime powers.

The construction of torpedo boats has been carried forward on a great scale by the continental powers in recent years. The subject is treated at length in a special chapter. Having recently made a large addition to the flotilla, the Admiralty are in a position to distribute boats more liberally for defensive purposes to the coaling stations abroad, and to the military and naval ports at home. If properly manned and regularly exercised, they may prove an important addition to the defence. More boats of improved types will be required to complete the defensive preparation of our vast empire. It will be sufficient to make the necessary provision by moderate annual instalments. For torpedo boat-catchers and for auxiliaries to the fleet, a far more powerful type is required. It is in this class, as it has already been urged, that our efforts should be more particularly directed.

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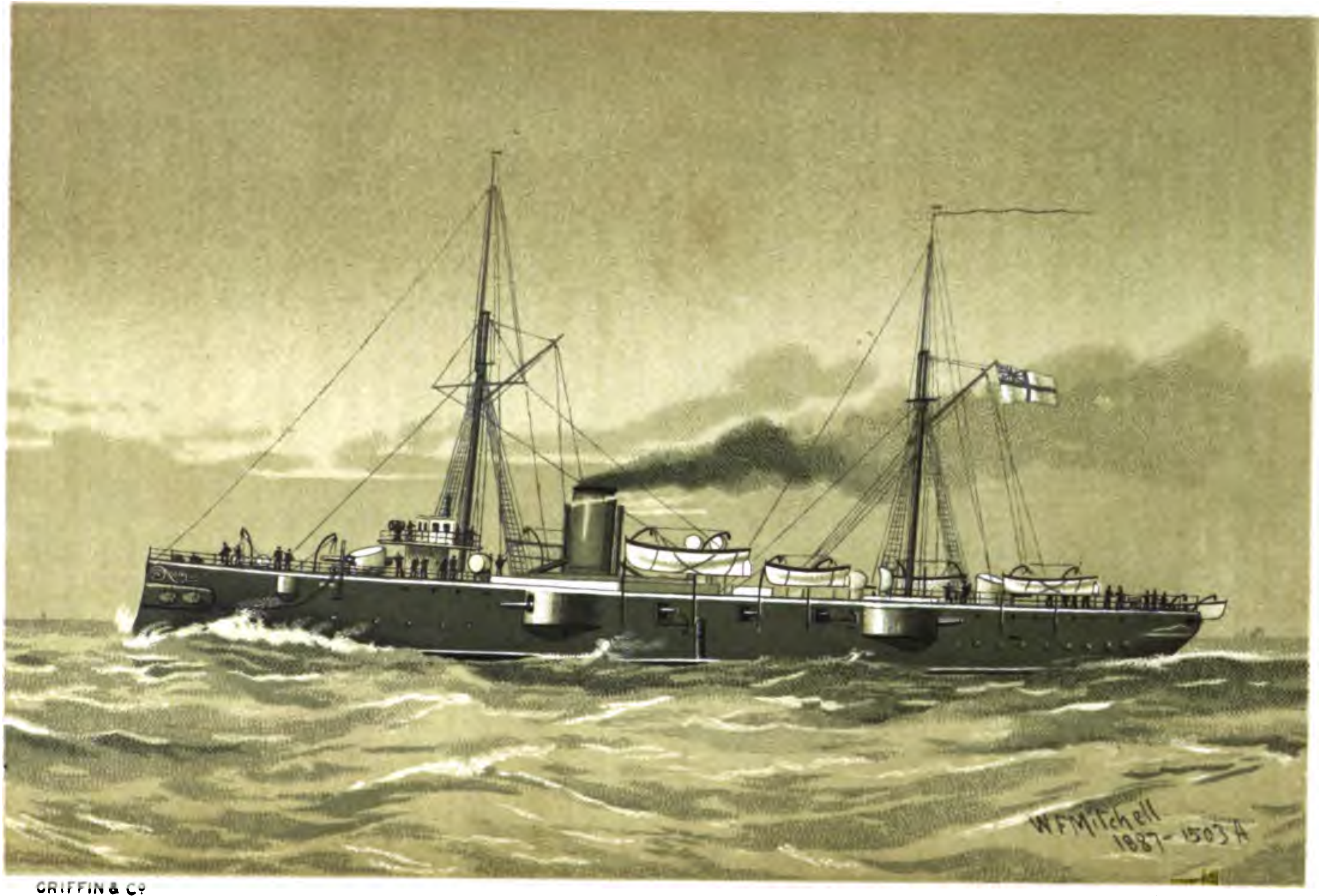

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H.M.S. "MERSEY."

Protection of commerce.

Having dealt with the several classes of vessels which would take their place in a naval battle, we pass to the fleet which is maintained to give protection to commerce. In the number of the Annual for 1886 details are given with a view to show the comparative strength of the principal maritime nations of Europe in ships for the line of battle. It will be useful here to compare the means at the disposal of these nations for the protection of their sea-borne trade. To this end a mere enumeration of ships designed for the purpose will not suffice. To enable us to form a correct estimate of the forces available, it is essential that we should have the means of considering also the extent of the interests to be defended.

Value of our over-sea trade.

In any comparison of our forces with those of other nations, it should be borne in mind that the whole of the external trade of the United Kingdom is carried by sea. The external trade of other maritime nations is to a large extent carried overland. In the year 1883 the percentage of imports and exports by land and by sea was as follows:—

	Imports.		Exports.	
	By Land.	By Sea.	By Land.	By Sea.
France	34	65	31	68
Germany	65	34	63	37
Russia (1881)	47	52	30	70
Italy	42	57	51	48

That these nations have means of obtaining supplies and of carrying on their external trade independently of that which in time of war might be interrupted or wholly destroyed by the cruisers of an enemy, is apparent, and any necessary supplies could probably be obtained in quantities sufficient at least for immediate requirements. With the United Kingdom, the case is otherwise. With our teeming population we are dependent on importation for the necessaries of life, and an interruption of supplies by an enemy even temporarily successful by sea might lead to irretrievable disaster. In the circumstances the extent of our preparations for the defence of our trade must ever be to us a matter of supreme interest and concern.

The following Table shows the extent of the Mercantile Marine of the principal European nations in 1883, and the value of their sea-borne trade:—

—	Merchant Vessels.		Sea-borne Trade.	
	Number.	Tonnage.	Imports.	Exports.
			£	£
France	15,222	1,003,679	153,054,200	124,078,240
Germany	4,315	1,269,477	85,873,800	92,855,200
Russia (1881)	4,790	500,554	42,624,920	55,428,800
Italy	7,471	973,333	31,336,890	24,381,120
Total	31,798	3,747,043	312,889,810	294,743,360
United Kingdom	24,675	7,242,216	426,892,000	305,437,000

It will be seen that the tonnage of the British shipping was nearly double, and that the imports and exports of this country were largely in excess of those of France, Germany, Russia, and Italy taken together. The corresponding figures for the present time would show a similar result.

Having shown the relative amount of the tonnage and trade of France and England, we may proceed to compare the extent and importance of the colonial possessions of the two countries, possessions which, together with their commerce, demand protection in time of war.

—	Area.	Population.	Imports and Exports.
	Square Miles.		£
French Colonies	931,000	31,000,000	30,180,000
British Colonies	8,958,000	283,676,000	405,579,000

From this statement it would appear that in extent and population our colonial possessions are more than nine times as great as those of France, while in respect of commerce our Colonies surpass those of France more than twelve times.

The mutual trade of the United Kingdom with its Colonies is estimated at the value of £250,000,000 to £300,000,000 per annum, and the total trade of the United Kingdom and its Colonies at not less than £1000,000,000 per annum. The shipping engaged is valued at £200,000,000. Further, it has been computed that there are constantly at sea, the property of the United Kingdom and its Colonies, goods to the value of £150,000,000, together with shipping to the value of £130,000,000. If we take our normal expenditure on the

Navy at £12,000,000, this amount represents a premium of but 1 per cent. on the value of the trade whose safety it is intended to insure.

In view of these statistics, the demand of Lord Charles Beresford for further additions to our unarmoured vessels of war is amply justified. We can indeed improvise in time of war armed cruisers from among the faster vessels of the Mercantile Marine, and we can do this to a greater extent than any other nation; but at the best, such vessels are makeshifts, and not equally matched with the regularly constructed and appointed ships of the enemy. The protection afforded by such vessels in time of war would nevertheless be of the highest value to our scattered merchantmen, and the measures taken by the Admiralty in the course of the present year to ensure that some of the fastest vessels about to be built for the American mail service shall be adapted for conversion into armed cruisers, and be available for that purpose should they be required, merit a warm tribute of praise.

To realise the havoc that cruisers of an enemy can work when ably commanded, we have but to recall the damage inflicted on our commerce by the French in the last century, under commanders of energy and determination, such as were Surcouf and Lemême. It is stated that in the years 1793 and 1794, no less than 788 British vessels were captured by the French cruisers.

The question of providing adequate protection for the Mercantile Marine cannot be too earnestly studied by those who are responsible. No question more urgently demands the attention of the Government and of the people of this country. In providing this protection the Colonies are deeply interested, and it is not unreasonable to expect that, the facts being fairly represented, the Colonies would be prepared to contribute a share of the cost proportionate to the interests involved.

M. Gabriel Charmes—Privateering.

The exponents of the public opinion of our maritime rivals are open in their declaration that they would assail us on the side where they know we are most vulnerable. Their efforts would be concentrated on the cutting up of our seaborne trade. To quote from M. Gabriel Charmes:—"There are a few trade routes, along which passes the wealth of the world, and on which is developed the very life of that immense world-wide British Empire. These routes, to some extent, correspond to the arteries. There are five or six, at the most ten. It would be an easy matter for us to scour them continually. True it is that formidable fortresses, such as Aden, Malta, and Gibraltar, afford some protection, but it is not under the guns of these fortresses that our cruisers would perform their exploits. They should avoid every known or avoidable risk. A warfare directed against the commerce of an enemy has its rules, and one must have the courage to formulate them exactly. The rule we would lay down should be this: Mercilessly attack the weak; without shame fly before the strong."

Lord Nelson on privateering.

This language may be contrasted with the more generous and lion-hearted counsels of Lord Nelson, as given in the fourth volume of his collected despatches:—"Respecting privateers, I own I am decidedly of opinion that with very few exceptions they are a disgrace to our country, and it would be truly honourable never to permit one after this war."

Unarmoured shipbuilding in France.

The line of policy in shipbuilding indicated in the writings of M. Gabriel Charmes was practically taken under the administration of Admiral Aube. The expenditure on ironclads was reduced to a sum of £510,000, distributed on the building and completing, necessarily at a leisurely rate of progress, the ships previously laid down. While the ironclads were comparatively neglected, the French have actually under construction the cruisers shown in the following list:—

		Tons.
20-knot ships	Davoust	3,027
	Suchet	3,027
19-knot ships	Tage	7,045
	Cecille	5,766
	Isly	4,160
	Jean Bart	4,160
	Alger	4,160
	Coëtlogon	1,850
	Cosmao	1,850
	Surcouf	1,850
	Forbin	1,850
	Lalande	1,877
	Tronde	1,877
	Collective Tonnage	43,499 *

We have here a total of fourteen ships, for the most part cruisers of the first class, and all are 19-knot ships at least.

Davoust & Suchet.

Some details of the Davoust and Suchet, about to be laid down at Toulon, were recently published. Their principal dimensions are as follows:—Length, 297½ feet; breadth, 40 feet; depth of hold, 25 feet 3 inches; draught of water, 17½ feet; displacement, 3027 tons; armament, four 6-inch or 4-ton guns, four quick-firing guns, six Hotchkiss guns, and four torpedo launching-tubes. These cruisers will be fitted with four masts, and fore and aft sails. The machinery will consist of two independent engines, each driving a single screw, and developing together 9000 horse-power, with forced draught. The speed will be 20 knots. The supply of coal will be 480 tons, or sufficient for 4000 miles at a speed of 12½ knots.

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* Two additional ships are projected: the Chanzy, of 20 knots speed and 3027 tons, and the Mogador, of 19 knots and 4325 tons.

General characteristics of French cruisers.

In none of the French cruisers will guns be carried of heavier calibre than our 6-inch guns. The speeds give the results anticipated with forced draught. The extreme coal endurance at moderate speeds may be taken at 4000 knots. The French journals speak with approval of the new unarmoured vessels now building.

Russia.

The construction of vessels of the same class is being commenced in Russia.

The Vitiaz, just completed, and the sister ship Rynda, completing, have a displacement of 2950 tons, 3600 horse-power, and a speed of from 15 to 16 knots. The principal dimensions are:—Length, 265¾ feet; beam, 46 feet; draught of water, 16 feet. The hulls are of steel, covered with a wood skin, and coppered. Protection is secured for the machinery by an armoured deck. The armament consists of ten 6-inch guns, six machine guns, and two torpedo launching-tubes. It has been reported that six more vessels of the Vitiaz type will be built.

A powerful cruiser, the Admiral Korniloff, was launched on the 9th April, 1887, by the Société des Ateliers et Chantiers de la Loire, from their yard at Nazaire, for the Russian Government.

The principal dimensions of this vessel, which was not included in the Parliamentary return obtained by Lord Charles Beresford in 1886, are as follows:—Length, 350 feet; beam, 48½ feet; I.H.P., 8260. The speed anticipated is 19 knots. The armament includes fourteen 6-inch guns, ten Hotchkiss, and six quick-firing guns.

German cruisers.

In Germany, as in the United States, armoured construction has, for the time at least, been abandoned, and the only ships of size in progress belong to the class of cruisers. The speeds show a general advance on the comparatively moderate standard with which the German Naval Administration has hitherto been content. The following is a list of the ships in hand, and the older vessels which they will replace:—

——	Displacement.	Speed.
Elizabeth Ariadne	4,250	18
Older vessel of the same name	2,508	12
Albatross	1,550	15
Older ship of same name	716	10
Greif type—two ships	2,000	19

Italian cruisers.

The Italians are building several cruisers of remarkable speed. The Dogali, a cruiser launched early in 1887 by the Armstrong Company and afterwards purchased by the Italian Government, has a displacement of 2200 tons. The speed realised was 19·66 knots. The coal supply is sufficient for 1100 knots, at full speed, and 4500 knots at most economical speed. The armament consists of six 6-inch guns mounted on Vavasour carriages, nine light B.L. guns, four machine guns, and four torpedo discharge tubes. The armoured deck has a minimum thickness of 1 inch, and a maximum of 2 inches.

Cruisers for United States.

After a long interval of inaction, Congress has at length been moved to greater liberality in its appropriations to the United States Navy. The increased expenditure is being devoted mainly to cruisers. The following ships are under construction:—

Name.	Displacement.	Speed. Knots.	Armament.
Baltimore . .	4,400	20	Four 8-in. B.L. guns; six 6-in. B.L. guns; six 6-pdr. Q.F.; ten machine guns.
Charleston . .	3,730	19	Two 10-in. guns; six 6-in. guns; machine guns under consideration.
Newark . . .	4,033	18	Twelve 6-in. guns; four 6-pdr. Q.F.; eight machine guns.

Tenders have been invited for two additional cruisers not yet named, designed for a speed of 19 knots. Tenders have also been called for two powerful gun-vessels of 1700 tons.

The description of the new cruisers proposed for the United States Navy is from the *New York Herald*.

They will be built of steel. Length, 288 feet; beam, 45·7 feet; draught of water, 17·4 feet; displacement, 4083 tons; twin screws; I.H.P., forced draught, 10,500; rig, three masts; fore and aft canvas.

The double bottom will extend over a length of 119·8 feet. The armoured deck amidships will be 19 inches above the water-line. It will meet the sides of the ship at a depth of 4 feet 3 inches below the water-line, and will extend from end to end of the ship. The extreme thickness of the inclined plating adjacent to the sides of the ship will be 4 inches.

The armament will consist of twelve 6-inch guns, carried on sponsons. The minor armament will include six machine guns, four quick-firing guns, and one Gatling.

The crew will number 300.

The coal supply will be 850 tons.

General conditions required in cruisers.

Having reviewed the shipbuilding in progress for the leading maritime powers, the policy announced by the British Admiralty of directing special efforts to the reinforcement of the Navy in ships for the protection of commerce will command universal approval.

The present Board of Admiralty have laid down, in the current financial year, five fast cruisers. The new class is thus described by the Portsmouth correspondent of the *Times*:—

The projected fast cruiser will be named the Melpomene. The Melpomene will be 265 feet in length and 41 feet in breadth, while her displacement will probably be 3000 tons. The measured mile speed with 400 tons of coal on board will be 19¾ knots, the ocean speed from 17 to 18 knots, and the radius of action at 10 knots' speed 8000 miles. She will have a protective deck extending from stem to stern, and sheltering the boilers, magazines, steering gear, &c. Above the protective deck the space is to be minutely subdivided, coal bunkers, upper dams, &c., being fitted as is usual in vessels of the class, while the bow will be strengthened for ramming. In all respects the ship will be more suitable for independent sea service, and for being driven at high speed in rough water. She will be entirely dependent upon her steam power and twin screws for propulsion, but will be provided with steadying sails. The armament will include six 6-inch breech-loading guns, nine quick-firing guns, and six torpedo tubes, all under cover. The Melpomene is to be completed in 1889.

Cruisers of the class laid down by the Admiralty, and with a high speed and light but long-range armament, are an essential part of the programme. For many services they are as efficient as large ships. It is, however, necessary to create a force under the British flag which will be as reliable, in all conditions of foreign cruising, as the large ships Tage and Cecille, now building in France.

In our new cruisers we can scarcely be content with a speed of less than 20 knots. Good seagoing qualities and ample accommodation for the crew are indispensable in a class of ships which may be required to keep the seas in all weathers and for long periods. The armament should consist of numerous guns of moderate calibre, length of range being a more important consideration than power of piercing those armoured vessels which should never be attacked by unarmoured cruisers. The offensive powers should include the torpedo and the ram.

Sir William Armstrong recommends Esmeraldas, while Sir Edward Reed advocates armour-plated cruisers of the Imperieuse and Warspite type, but with extended belts, and the speeds increased from 16 to 20 knots. The Esmeralda has not been sufficiently tried at sea to establish the suitability of the type for a sea-keeping ship. Freeboard is an element of seaworthiness, and the Esmeralda lies rather low in the water.

It should be a main object in the design of our cruisers, and it cannot be impracticable, largely to increase their coal supply. Some sacrifice of armament, or even an addition to displacement, would be justified in order to secure a more adequate supply of coal.

Masted and mastless ships.

In connection with shipbuilding, a few observations may appropriately be made in reference to the diminished use of canvas in the Navy.

For ironclads propelled with twin screws, sails have been wisely abandoned. In the Imperieuse it was evident that the heavy rig must be more a hindrance than a help. On similar grounds sail power has been greatly cut down in the cruisers of the Leander class, and practically abandoned in the later ships of the Forth type.

The rig of cruisers will probably depend on the displacement and method of propulsion. While small ships will feel their canvas more than heavy ships, in the case of larger vessels propelled with twin screws the chance of disablement is less than with the single screw. For all vessels other than ironclads steadying sails must be useful, and they may be carried without encumbering ships with heavy top-hamper. The masts, which are indispensable as part of the fighting equipment, for look-out purposes, for signalling, and to carry machine guns, may be utilized for carrying fore and aft sails. The ample spread of canvas, which is required for cruising, without the aid of steam, will be confined to the small cruisers and the gun vessels. Independence of coal supply is essential for a few vessels in the Pacific, and must always be valuable in economising fuel on a long cruise.

Personal prejudice in favour of sails.

An old yachtsman's admiration for the noble masted ships of the type represented by the Alexandra, Sultan, and Hercules, is, perhaps, a pardonable weakness. Their lofty spars can be sent down for battle, or when making passages against head winds, and they furnish useful materials for the construction of booms, a new requirement of our modern fleets. Sails economise the consumption of coal—an important consideration when ships are required to keep the seas. In war a few ironclads would be required as ocean cruisers, and to support the lighter vessels. In peace sails give interest and variety to the sailor's life, and do good service as a gymnasium.

The advocates of mastless ships have been confirmed in their views by the apparent impossibility of establishing a reasonable compromise between the mastless turret-ship and the over-masted Imperieuse. We see the compromise carried out with judgment and by the light of long experience in the Etruria and Umbria, and in the ships of the White Star line. Their spars are not heavy enough to be a hindrance. In head winds, the speed is reduced, not by the resistance of the spars, but by the racing of the screw. Their canvas will sometimes assist a passage under steam, and in the case of a breakdown it affords the means of keeping the ship under command, and making progress towards the nearest port. The Germanic, when she broke down in mid-Atlantic, made 170 miles a day under sail on the passage to Liverpool.

Failure of British cruisers of "C" and Gem class in point of speed.

Turning from propulsion by means of canvas to propulsion by steam, criticism has been provoked by the inferiority of many types in the British Navy. The want of speed is due in these cases to the limitations as to length imposed on our constructors. It has been insisted that no ship should be built for the purposes of war which is not capable, to use the words of Mr. White, "of turning rapidly and charging down upon her enemy to ram her."

Comparisons—French ships.

If we compare vessels such as H.M.S. Archer and the French Milan, it is evident that the naval constructors of the French Navy have not been fettered by similar restrictions

———	Archer.	Milan.
Displacement in tons	1630	1540
Length	225 feet	303 feet
Beam	36 „	32·10 „
Speed	17½	18

We find the same difference in the relative proportions of breadth to length in vessels of a larger class. The French have now under construction three vessels, the Forbin, Tronde, and Surcouf of 1850 tons. Their length is 312 feet, beam 30 feet 5 inches, estimated speed 19·5 knots. Long, lean vessels have an unquestionable advantage in speed, and for certain services speed is a quality for which much may be sacrificed; but our constructors must not be betrayed by competition on the measured mile into the fatal error of adopting forms which are unseaworthy.

While there is some risk that the quality of seaworthiness may be neglected in the desire to gain additional speed, the ability to carry armament should not be put out of view. The following table, prepared by the United States Naval Department, gives a comparison of some recent ships of the British and French navies in relation to speed and weight of fire.

——	Date.	Displacement.	Speed.	Weight of Fire, Broadside.
				lbs.
British Comus Class	1881	2,380	13–14	700
French Corvettes—				
Primauguet D'Estaing La Perouse	1882	2,400	15·4	492
Forfait and three others	1879–81	2,268	15·5–14·3	492
Torpedo Cruisers—				
French—Milan	1884	1,546	18·4	125
British Archer	..	1,600	16·0	300
British Surprise	..	1,400	17·0	..

As we have referred to the deficiency in speed of the Comus class, in justice to our constructors and to the naval officers, under whose directions our ships have been designed, it is but fair to call attention to the superiority of our ships in armament. We may assume a further advantage in solid strength and seaworthiness, which the seaman would not lightly value in storm and tempest.

Comparisons—German training squadron.

Examining our shipbuilding in former years in relation to the decision now finally taken to subordinate the use of sails in war to efficiency under steam, it is regrettable that forms more favourable for sailing than steaming were so long retained in the designs of our cruisers. But we may fairly claim for our shipbuilding in the past that it was on a level with the ideas of the day as generally accepted by naval officers and constructors in all countries.

An illustration was afforded on the occasion of the recent visit of the German squadron to the noble harbour of Sydney. The German ships are well adapted to the work on which they were emyloyed. They have the same good qualities and the same deficiencies as are found in our ships. They are thoroughly seaworthy and sail fairly. Their speed is not sufficient to give protection to commerce from the highly subsidised ocean mail steamers both of France and Germany.

The following table gives a comparison of the Russian ships in the

Comparisons—Russian cruisers in Pacific.

China Sea, and German and English unarmoured ships recently lying side by side at Sydney:—

—	Date of Launch.	Displacement.	Indicated Horse-power.	Speed.	Armament.
Russian—					
Opridchnik . .	1880	1,426	1,685	13	Four 6-in. or 4-ton guns.
Nayezdnik . .	1878	1,334	1,719	13	Three 6-in. or 4-ton guns.
Razbodnyik . .	1878	1,329	1,786	12	—
Djigitd . .	1876	1,456	1,383	12	—
German—					
Bismarck . .	1877	2,856	2,529	13	Sixteen 15-centimetre or 3½-ton guns.
Carola . .	1880	2,169	2,340	14	Eight 15-centimetre or 3½-ton guns.
Olga . . .	1880		2,397		
Sophie . .	1881		2,100		
British—					
Opal . . .	1875	2,120	2,190	13	Twelve 64-pounders; six machine guns.
Diamond . .	1874	1,970	2,140	13	

If we have until recently been behind the French in speed in the unarmoured class, we were certainly ahead of them in our ironclads. The following table of recent trials, taken from the *Times*, shows results of which our engineer contractors have no reason to be ashamed.

Ship.	Natural Draught.	Forced Draught.
Collingwood:—		
Indicated horse-power	8,099·84	9,573·0
Speed	16·603	16·844
Howe:—		
Indicated horse-power	7,733·42	11,728·8
Speed	15·872	16·936
Rodney:—		
Indicated horse-power	8,259	11,156
Speed	16	16·9
Benbow:—		
Indicated horse-power	8,658	10,860
Speed	16·5	17·5
Camperdown:—		
Indicated horse-power	8,605·96	11,740·88
Speed	16·305	17·144
Anson:—		
Indicated horse-power	8,319·12	12,567·78
Speed	16·523	17·485
Warspite	15½ knots.	17¼ knots.
Belted Cruiser.		
Orlando	17·28 ,,	18·75 ,,

The advance in speed in the unarmoured and protected vessels is not less remarkable.

Ship-building improvements and conversions.

Thus far we have been treading on comparatively sure ground, following the opinion of the great majority of officers of the Navy. In the suggestions now to be submitted, the present writer must lean on the comparatively slender support of a civilian's personal convictions. It seems, however, a duty to make use of the present opportunity to put forward suggestions for consideration.

Superstructure—Gorgon class.

No difficulty is anticipated in securing the concurrence of the Admiralty to a proposal, not now for the first time put forward, that the remaining ships of the Gorgon class should be taken in hand, for the purpose of adding the superstructure which is wanted to make them thoroughly seaworthy. We are decidedly deficient, as compared with the French, in armoured vessels of moderate draught. Our list of light draught vessels includes:—

	Draught.	
	Ft.	Ins.
Belleisle and Orion	21	0
Glatton (requires a superstructure for seaworthiness)	19	0
Penelope	17	6
Four Gorgon class	16	4

The first three vessels on the list are not sea-keeping vessels. The Penelope, our only light draught sea-going vessel, is one of our early ironclads. The superstructure already added to one vessel of the Gorgon class has been found quite satisfactory. All the other vessels of the same class should be similarly treated.

Second-class ironclads.

We now come to a larger and more debateable proposal. It is, however, urged with confidence on the consideration of the Admiralty. The proposal is that our second-class ironclads should be fitted with triple-expansion engines of sufficient power to give them a speed of at least 15 knots at sea. With this improved type of engine the coal endurance would be largely increased.

The recent changes in guns and armament, the great increase in number and efficiency of the light guns, have tended to improve relatively the fighting efficiency of the earlier ironclads. It has become a question whether it is not preferable to have an extended area of side protected by armour, though of less thickness, rather than to concentrate armour of greater thickness upon a much more limited area of side.

Opinions and experiments in French service.

In his recent *brochure*, M. Weyl has some observations on this subject, which should arrest the attention of naval administrators and constructors:—

"What will become of these fleets of to-day of which we are so proud? Shells bursting in the interior of a ship will cause enormous loss. In looking to the future, we seem to ask ourselves whether we shall not be compelled to return to the system of a complete armour for ships, and if it is judicious to lay down even cruisers of high speed without any vertical armour. It is of the last consequence to make shells burst outside the ships, and the only position of safety will be behind armour. To cover with armour the whole of the upper works of large ships may become an absolute necessity. We cannot be blind to the gravity of the situation. Our large ships have been partially deprived of their armour to economise weight, tonnage, and money. They must again be enveloped in a complete suit of armour in order to be able to fight with chance of success. The era of ships of small tonnage seems by no means near at hand."

It is understood that experiments have been carried out at Bourges and Gavres with shells loaded with melanite, roburite and dynamite. The results have provoked a general demand from the French Navy for complete protection by armour from such overwhelming destruction as would be caused by the bursting of these missiles inside a ship.

It is stated that the Italian Government has contracted for the construction in Philadelphia of a pneumatic dynamite gun, for delivery at the Spezzia naval station. This gun, the construction of which has been commenced, is to throw a shell containing 600 lbs. of dynamite four miles.

The accession of M. Barbey to the ministry of marine is understood to imply a general reversal of the policy of Admiral Aube in relation to shipbuilding.

Spanish shipbuilding policy.

In Spain a similar reversal of policy has taken place. A year ago Vice-Admiral de Beranger asked for a credit of 189 millions of francs for the execution of an extensive programme of construction. Only light ships were to be built. No vessel protected with an armour belt was contemplated.

The question of the constitution of the fleet has been the subject of recent discussions in the Spanish Cortes. M. Canovas del Castillo, the leader of the Conservative party, delivered a speech which made a great impression, the Liberal Cabinet of M. Sagasta having invited him to preside over the special commission on the reconstitution of the Spanish Navy. "When," he said, "the scheme for the reconstitution of the fleet was laid before the Cortes, there was a general impression that torpedo boats would make it absolutely unsafe for ironclads to keep the seas, and would prevent them from making use of the immense powers of destruction which they possess. The current of opinion among officers was now setting decidedly in favour of armoured ships for the line of battle." The orator proceeded to put questions to the new Minister of Marine, Admiral Rodriguez de Arias, who in reply declared himself in favour of ironclads as against torpedo cruisers.

Resistance and Provence experiments.

The series of experimental attacks with the torpedo against the Resistance may almost be considered a victory for the ironclads of the old type. With every condition in favour of the attack, the torpedo did not accomplish its work of destruction until it had been placed in contact with the ship with a deliberation which would not have been permitted to the assailant in actual warfare. A similar experimental attack was made by the entire French fleet on the wood-built ironclad Provence. The object was to test the power of the old armour to resist the latest guns. The fire did great destruction in the upper works, but the ship was not sunk. It would have been interesting to test the effect of an equally heavy fire on a ship plated in the modern fashion with thick armour concentrated on a small area, and a large surface of the upper works completely unprotected. If the crews stationed at their light guns had remained at quarters the carnage would have been fearful. It must be acknowledged that no system of armour can give complete protection against the light guns which now form so important a feature in the armaments of ships. The method of protection adopted in the earlier days of ironclads offers considerable advantages in this respect over the later system of thick but concentrated armour, leaving large areas without protection against light projectiles.

Chief defect of Audacious—want of speed.

The chief defect of the Audacious class lies in their want of speed and limited coal endurance. In the presence of an enemy, two or three slow ships may impede in a fatal manner the movements of an Admiral. An illustration has been recently afforded in the manœuvres in the Irish Channel. Looking to the solid construction of the hulls, and the effective distribution of armour, the ships of the Audacious class must be admitted to be worth a breech-loading armament and improved machinery. In comparison with the same expenditure in building new ships the results would be immediate and obtained at moderate cost. It is a consideration of weight in favour of adapting our old ironclads to modern requirements, that we shall thereby secure for ourselves a great advantage from our early adoption of the system of building the hulls of armoured ships in iron, as against the construction in wood, to which the French too long adhered.

Comus class.

From the ironclads of the Audacious class we turn to the protected corvettes of the "C" type. We have nine vessels of this class, well armed, strongly built, protected by the most approved method of armoured decks, coffer dams, and internal bulkheads. Owing to the complicated system of construction, the cost of our later corvettes, when measured per ton, comes near to the cost of ironclads. It is much to be regretted that, through deficiency of speed, they are practically unavailable for the protection of commerce. Want of length is the cause of the failure in this respect.

The Admiralty should order a most careful examination of the "C" class. It should be ascertained by experiment what additions to length and steam power are necessary to raise the speed to fifteen knots. The cost of conversion should be estimated. We will not anticipate the result, but if found practicable and not unduly costly, it would be a great gain to the Navy to raise these nine strongly-built, well-armed, and elaborately subdivided corvettes, from thirteen- to fifteen-knot ships.

Naval readers must have a vivid recollection of the position in which the Admiralty found itself in contemplation of a probable war with Russia. It was painful to realise how slender was the service which our corvettes of a recent and very costly type, and the unarmoured ships of the Navy generally, were capable of rendering. Large sums of money had been lavished on devices for protection and in modern armaments; but the ships were too slow to overtake a modern Alabama. The great success achieved with triple-expansion engines in raising the speed of the Malabar to 15½ knots should encourage the Admiralty to take in hand a class of vessels of which we should stand in urgent need in time of war.

Northumberland class as Heclas.

The conversion of our old-fashioned ironclads of the Northumberland type seems worthy of consideration. With double- or triple-expansion engines their speed might be raised to sixteen knots. With this increased speed and a suitable light armament and rig, they might accompany a fleet as armed Heclas. The hulls are in good condition, and it may be possible to make the conversion for something like half the cost of a new ship, having equal accommodation. The subject, which has already engaged the attention of the Admiralty, seems worthy of careful re-examination.

The financial argument.

M. Leroy Beaulieu, in an article in the French *Economist* of the 16th April, has some remarks bearing on the policy of adapting the *matériel* of the Navy to the changes in the methods of maritime warfare. "Nowhere," he says, "more than in the forces of the Navy and the Army do we see indications of that sort of *vogue irréfléchie* (which may perhaps be translated thoughtless impatience to be in the new fashion of the day), which bleeds to death the financial resources of the European powers. Five, six, eight, ten years ago everybody thought of nothing but ironclads. The most gigantic dimensions were demanded, and in truth the whale presented the type which all the constructors sought to imitate. Many governments, that of Italy among others, incurred great expense in order to procure the largest ironclads which could be built. Later, it was the fashion to condemn the ironclad as a superannuated instrument of war, something analogous with the coat of mail of the knights of the Middle Ages. The torpedo boat, it was said, was an instrument of war more swift in action, always under control, which would command the sea. Men thought of nothing but the construction of torpedo boats, and to cover the sea with flying squadrons of such vessels was to secure the naval supremacy. But to-day, after trials have been made, it seems that the enthusiasm for the torpedo boat has abated. The torpedo is no longer to be classed so high in the naval armoury. It is to be nothing more than an auxiliary, and to take a subordinate place. The chief part will no longer be filled by the torpedo boat, nor yet by the ironclad. A new type, the swift cruiser, will become the favourite of the day; we say of the day, or, if you like, of the year, for these favourites are ephemeral. Ought we not (he asks) to make some effort to withdraw ourselves from the yoke laid upon us by all these precarious and somewhat fleeting fancies? Should not some check be placed upon these demands for perpetual change? Should it not be remembered that an instrument of war depends for its value not only upon the weapon itself, but on the training and knowledge of those in whose hands it is placed? Ought we not to remember that in the naval battle of Lissa a mere wood-built ship, commanded by Admiral Tegethoff, sunk a magnificent ironclad, and that in the war of 1870 our famous machine guns, about which there had been so much stir and so much mystery, rendered no appreciable service?"

Austrian conversions.

The financial argument may be urged in support of the policy of adapting the Audacious class to modern requirements. The Austrian naval administration have completely reconstructed some of their earlier ironclads with great success.

Summary of types proposed for the shipbuilding programme.

A general review of contemporary shipbuilding at home and abroad has brought clearly into view the most immediate and urgent requirements of the British Navy. On the value of rams and torpedo catchers no difference of opinion exists. On the armoured gunboats suggested by Sir George Elliot opinion is more divided. The type should be carefully considered, and an experimental vessel should be put in hand. We too frequently build a whole class before we have fully tested the type at sea.

For the defence of commerce it is difficult to put a limit on our requirements. The amount of construction in this line can only be measured by the liberality of Parliament. Our tonnage of fast ocean cruisers in construction should double the amount in progress in France.

For the defence of harbours the construction of torpedo boats should go steadily forward. In the small class to be carried on board ship our requirements will be considerable in point of numbers; but boats of this description will not be costly, and they can be rapidly constructed.

The proposals submitted in the present chapter may be summarised as follows:—

A. Shipbuilding programme.

Armoured rams.
Armoured gun vessels.
Torpedo boat-catchers and look-out vessels.
Fast cruisers. { First class 20 knots, over 3000 tons.
Second class 20 knots, under 3000 tons.

B. Alterations and conversions, with re-armament.

1. Gorgon class. Superstructures to be added.
2. Audacious class. Triple-expansion engines.
3. Comus class. Lengthening and triple-expansion engines.
4. Northumberland type. Triple-expansion engines, and to be fitted as a floating factory and torpedo boat-carrier.

In the discussion of the shipbuilding policy it has been the aim to throw light on a subject of perplexing intricacy, and in which the judgment is baffled by the close balance of advantages and disadvantages. It has not been attempted to fix numbers. Having determined the types which give the highest promise of efficiency, the amount of construction will depend on the activity displayed elsewhere, and on the judgment of the Admiralty as to our relative position.

CHAPTER XI.

NAVAL STRENGTH AND RESOURCES OF ENGLAND.

Comparative strength of the British, French, and Russian fleets.

IN the first issue of *The Naval Annual*, tables were given showing our relative position in ships built and building with reference to the French Navy. In the present number a similar statement is given for the year ending the 31st March, 1891, the ships of the Russian Navy having been added to the former list. Such a statement is not put forward as a full measure of the comparative resources of the maritime powers. Naval strength cannot be measured in ships alone; and in comparing lists of ships there are always those qualifying circumstances to be taken into account, which were referred to by the Earl of Beaconsfield when speaking in the House of Commons in 1862:—"I think the time has not yet come when the rival power of England and France can be counted in iron ships. . . . I believe the statement by the noble lord a monstrous mystification. The noble lord always seems to count an order to construct an iron ship as an actual ship, forgetting altogether that in France, when an order is given in the bureau of the Minister of Marine, sometimes it takes ten years to execute, and occasionally three or four years elapse before the construction of the vessel is commenced."

Imperfect as it is, the tables offer a certain gauge of the relative position of navies. It will be seen that the British Navy is especially deficient in coast-service vessels. This deficiency has been pointed out in some former observations.

Comparative Statement of the Armoured Fleets of England, France and Russia, 31st March, 1891. The date of completion of Russian Ships building is uncertain.

TABLE I.—FIRST CLASS.

Hulls of Iron. Maximum Armour not less than 9 inches. Displacement exceeding 8500 tons.

ENGLAND.

Name.	Displacement.	Speed.	mum Armour.	Armament (Heavy).	Date of Launch.
	Tons.	Knots.	Ins.	M.L.	
Dévastation	9,330	13·84	14	4 35-ton	1871
Dreadnought	10,820	14·20	14	4 38 „	1875
Inflexible .	11,880	13·80	24	4 80 „	1876
Neptune .	9,310	14·20	13	4 38 „	Purchased in 1878
Thunderer .	9,330	13·40	14	2 38 „	1872
Alexandra .	9,490	15·00	12	2 25 „	1875
Hercules .	8.680	14·00	9	8 18 „	1868
Sultan . .	9,200	14·13	9	8 18 „	1870
Téméraire .	8,540	14·50	11	4 25 „	1876
Superb . .	9,170	13·50	12	16 18 „	Purchased in 1878
Ajax . .	8,510	13·25	18	4 38 „	1880
Agamemnon	8,510	13·25	18	4 38 „	1879
				B.L.	
Edinburgh .	9,150	15·50	18	4 45 „	1882
Colossus .	9,150	15·50	18	4 45 „	1882
Collingwood	9,150	16·84	18	4 45 „	1882
Howe . .	9,700	16·93	18	4 67 „	1885
Rodney . .	9,700	16·90	18	4 67 „	1884
Benbow . .	10,000	17·5	18	2 111 „	1885
Camperdown	10,000	17·14	18	4 67 „	1885
Anson . .	10,000	17·43	18	4 67 „	1886
Sans Pareil	10,470	16·75	18	2 111 „	1887
Victoria .	10,470	16·75	18	2 111 „	1887
Nile. . .	11,940	16·50	18	4 67 „	Bldg.
Trafalgar .	11,940	16·50	18	4 67 „	1887
Total 24	234,440				

FRANCE.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.
	Tons.	Knots.	Ins.		
Amiral Duperré .	11,100	14·22	21½	4 48-ton	1879
Dévastation	10,100	15·17	15	4 48 „	1879
Redoutable	9,200	14·66	14	8 24 „	1876
Courbet .	9,700	14·20	15	4 48 „	1882
Amiral Baudin .	11,880	15·00	21½	3 75 „	1883
Formidable	11,441	15·00	21½	3 75 „	1885
Neptune .	10,581	15·00	18	2 52 „	1887
Hoche .	10,581	15·00	18	2 52 „	1886
Marçeau .	10,581	15·00	18	4 52 „	1887
Magenta .	10,581	15·00	18	4 52 „	Bldg.
Total 10	105,245				

RUSSIA.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.
	Tons.	Knots.	Ins.		
Baltic Fleet.					
Peter the Great.	8,749	13·00	14	4 40-ton	1872
Alexander II.	8,440	16·00	14	2 50-ton, 4 15-ton	1887
Emperor Nicholas .	8,440	16·00	14	2 50-ton, 4 15-ton	Building.
N. . . .	9,800	..	..		Building.
Black Sea Fleet.					
Catherine II.	10,150	15·00	16	6 50-ton	1886
Sinope . .	10,150	15·00	16	6 50-ton	1887
Tchesmé .	10,150	15·00	16	6 50-ton	1886
Total 7	65,879				

TABLE II.—SECOND CLASS.

Hulls of Iron (I.) or of Wood (W.). Maximum Armour not less than 8 inches. Displacement not exceeding 8500 tons.

ENGLAND.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.	M.L.		
Monarch	8,320	14·94	10	4 25-ton	1868	I.
Audacious	6,010	13·20	8	10 12 „	1869	I.
Belleisle	4,870	12·20	12	4 25 „	1876	I.
Invincible	6,010	14·09	8	10 12 „	1869	I.
Iron Duke	6,010	13·64	8	10 12 „	1870	I
Nelson	7,630	14·41	9	4 18,8 12	1876	I.
Northampton	7,630	13·17	9	4 18,8 12	1876	I.
Swiftsure	6,910	13·75	8	10 12-ton	1870	I.
Triumph	6,640	13·75	8	10 12 „	1870	I.
Orion	4,870	13·00	12	4 25 „	1879	I.
Shannon	5,390	12·35	9	2 18 7 12	1875	I.
Hotspur	4,010	12·80	11	2 25-ton	1870	I.
				B.L.		
Imperieuse	8,000	17·00	10	4 22-ton	1883	I.
Warspite	8,000	17·00	10	4 22 „	1884	I.
Conqueror	6,200	15·50	12	2 45 „	1881	I.
				M.L.		
Rupert	5,440	13·59	14	2 18 „	1872	I.
				B.L.		
Hero	6,200	15·50	12	2·45-ton	1886	I.
Aurora	5,000	18·00	10	2 22 „	1887	I.
Australia	5,000	18·80	10	2 22 „	1887	I.
Galatea	5,000	18·00	10	2 22 „	1887	I.
Immortalité	5,000	18·00	10	2 22 „	1887	I.
Narcissus	5,000	18·00	10	2 22 „	1887	I.
Orlando	5,000	18·00	10	2 22 „	1887	I.
Undaunted	5,000	18·00	10	2 22 „	1887	I.
Total 24	143,140					

FRANCE.

Name.	Displacement.	Speed	Maximum. Armour.	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.			
Colbert	8,457	14·47	8½	8 23-ton	1875	W.
Trident	8,800	14·17	8½	8 23 „	1876	W.
Richelieu	9,100	13·11	8½	6 23 „	1873	W.
Friedland	8,540	13·30	8	8 23 „	1873	I.
Marengo	7,187	13·49	8¾	4 23 „	1869	W.
Suffren	7,600	14·30	8	4 23 „	1870	W.
Océan	7,500	13·70	8	4 23 „	1868	W.
Bayard	5,881	14·00	10	4 16 „	1880	W.
Turenne	6,000	14·14	10	4 16 „	1879	W.
Fulminant	5,574	13·22	13	2 23 „	1877	I.
Tonnerre	5,574	14·01	13	2 28 „	1875	I.
Vauban	5,900	14·32	10	4 16 „	1882	I.
Terrible	7,200	14·50	19½	2 75 „	1881	I.
Furieux	5,560	14·00	17¾	2 48 „	1883	I.
Indomptable	7,168	15·00	20	2 75 „	1883	I.
Duguesclin	5,869	14·00	10	4 16 „	1883	I.
Caiman	7,230	14·50	19½	2 75 „	1885	I.
Requin	7,230	14·50	19½	2 75 „	1885	I.
Total 18	126,270					

RUSSIA.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.
	Tons.	Knots	Ins.		
Dimitri Donskoi	5,754	15	14	4 9-ton, 3 28-ton	1883
Vladimir-Monomach	5,754	15	12	4 9-ton	1882
Admiral Nachimoff	7,782	16	10	4 9-ton	1885
Alexander Nevsky	7,572	16	12	2 9-ton	Bldng.
Total 4	26,862				

NOTE.—Three French ships slightly exceed the limit of 8500 tons. They practically belong to the class included in this division.

TABLE III.—THIRD CLASS.

Hulls of Iron (I.) or of Wood (W.). Armour 4½ to 6 inches.

ENGLAND.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.	M.L.		
Penelope .	4,470	12·76	6	8 9-ton	1867	I.
Defence .	6,270	11·62	4½	2 9 ,,	1861	I.
BlackPrince	9,210	13·6	4½	4 9 ,,	1861	I.
Hector. .	6,710	12·36	4½	2 9 ,,	1862	I.
Minotaur .	10,690	14·41	5½	17 12 ,,	1863	I.
Achilles .	9,820	14·32	4½	14 12 ,,	1863	I.
Valiant .	6,710	12·65	4½	2 9 ,,	1863	I.
Agincourt	10,690	14·80	5½	17 12 ,,	1865	I.
Bellerophon	7,550	14·17	8	10 14 ,,	1865	I.
Northumberland.	10,780	14·13	5½	7 12 ,, 20 9 ,,	1866	I.
Warrior .	9,210	14·40	4½	4 9 ,, 28 6½,,	1860	I.
Total 11	92,110					

FRANCE.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.			
La Galissonnière	4,700	13·08	6	6 16-ton	1872	W.
Victorieuse	4,600	12·75	6	6 16 ,,	1875	W.
Triomphante	4,700	12·89	6	6 16 ,,	1877	W.
Héroïne .	5,887	13·00	6	8 16 ,,	1863	I.
Thétis . .	3,621	12·00	6	6 8 ,,	1877	W.
Total 5	23,508					

RUSSIA.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.			
Admiral Chichagoff	3,511	10·00	6	2 28-ton	1868	I.
Admiral Greig	3,593	10·00	6	3 28 ,,	1868	I.
Admiral Lazareff	3,556	10·00	6	3 28 ,,	1867	I.
Admiral Spiridoff	3,740	10·00	6	2 28 ,,	1868	I
General Admiral	4,604	12·00	6	4 9 ,,	1873	I.
GrandDuke Edinburgh	4,604	12·50	6	4 9 ,,	1875	I.
Minin . .	6,168	13·00	7	4 9 ,,	1878	I.
Kniaz-Pojarski	5,007	10·00	4½	8 9 ,,	1867	I.
Kreml. .	3,664	8·00	6	14 9 ,,	1864	I.
Netron-menja	3,494	8·00	5½	14 9 ,,	1864	I.
Pervenetz.	3,279	9·00	4½	10 9 ,, 1 15 ,,	1863	I.
Total 11	45,212					

TABLE IV.—COAST DEFENCE VESSELS.

ENGLAND.

Name.	Displacement.	Speed.	Maximum Armour	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.	M.L.		
Glatton . .	4,910	12·11	14	2 25-ton	1871	I.
Cyclops . .	3,480	11·00	10	4 18 „	1871	I.
Gorgon . .	3,480	11·14	10	4 18 „	1871	I.
Hecate . .	3,480	10·90	10	4 18 „	1871	I.
Hydra . .	3,480	11·20	10	4 18 „	1871	I.
In Colonies.						
Abyssinia.	2,900	9·59	10	4 18 „	1870	I.
Cerberus .	3,480	9·75	10	4 18 „	1868	I.
Magdala .	3,340	10·67	10	4 18 „	1870	I.
Scorpion .	2,750	10·51	5	4 12 „	1863	I.
Wivern . .	2,750	10·06	5	4 12 „	1863	I.
Prince Albert	3,880	11·65	10	4 12 „	1864	I.
Armoured Gunboats.						
Viper . .	1,230	9·59	4½	2 6½ „	1865	I.
Vixen . .	1,230	8·89	4½	2 6½ „	1865	I.
Total 13	40,380					

FRANCE.

Name.	Displacement.	Speed.	Maximum Armour	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.			
Tonnant .	4,707	11·00	18	2 48-ton	1880	I.
Tempête .	4,523	10·20	13	2 28 „	1876	I.
Vengeur .	4,523	10·83	13	2 48 „	1878	I.
Bélier . .	3,600	12·37	8½	2 16 „	1870	W.
Bouledogue	3,400	12·25	8½	2 16 „	1872	W.
Cerbère .	3,800	11·39	8½	2 16 „	1868	W.
Armoured Gunboats.				c/m guns.		
Flamme .	1,045	13·00	10	1 16-ton	1885	I.
Fusée . .	1,045	13·00	10	1 16 „	1884	I.
Grenade .	1,045	13·00	10	1 16 „	1884	I.
Mitraille .	1,045	13·00	10	1 16 „	1886	I.
Achéron .	1,640	13·00	8	1 28 „	1885	I.
Cocyte .	1,640	13·00	8	1 28 „	1887	I.
Phlégéton	1,640	13·00	8	1 28 „	Bldg.	I.
Styx . .	1,640	13·00	8	1 28 „	Bldg.	I.
Total 14	35,293					

RUSSIA.

Name.	Displacement.	Speed.	Maximum Armour.	Armament (Heavy).	Date of Launch.	
	Tons.	Knots.	Ins.			
Monitors—Baltic.						
Czarodeika	2,026	8	6	4 15-ton	1867	I.
Rusalka .	2,206	8	6	4 15 „	1867	I.
Smertz. .	1,520	8	6	2 15 „	1864	I.
Bronenosetz	1,482	7	11 1-inch laminated			
Edinorog .	1,407	6	„	2 15 „	1864	I.
Koldun .	1,666	8	„			
Latnik .	1,515	6	„			
Lava . .	1,591	7	„	2 15 „	1864	I.
Perun . .	1,549	6	„	2 15 „	1864	I.
Strelotz .	1,431	6	„	2 15 „	1864	I.
Tifun . .	1,666	6	„	2 15 „	1864	I.
Uragan .	1,415	6	„	2 15 „	1864	I.
Veshtchun.	1,448	6	„	2 15 „	1864	I.
Popoffkas—Black Sea.						
Novgorod .	2,706	6	9	2 29 „	1873	I.
Admiral Popoff .	3,590	6	16	2 40 „	1875	I.
Total 15	27,038					

SUMMARY—IRONCLADS.

1891.

ENGLAND.			FRANCE.			RUSSIA.		
Class.	Ships.	Displacement.	Class.	Ships.	Displacement.	Class.	Ships.	Displacement.
		Tons.			Tons.			Tons.
1st	24	234,440	1st	10	105,245	1st	7	65,879
2nd	24	148,140	2nd	18	126,270	2nd	4	26,862
3rd	11	92,110	3rd	5	23,508	3rd	11	45,212
Coast Defence. .	13	40,390	Coast Defence. .	14	35,298	Coast Defence. .	15	27,038
Total . .	**72**	**510,080**	**Total** . .	**47**	**290,321**	**Total** . .	**37**	**164,991**

Unarmoured and Protected Cruisers built and building.

Speed not less than 13 knots.

Speed.	England.		France.		Russia.	
	Name.	Displacement.	Name.	Displacement.	Name.	Displacement.
Knots.		Tons.		Tons.		Tons.
20 or over	Medea	2,800	Chanzy*	3,027	Ilyen	600
	Medusa	2,800	Davoust	3,027	Captain Sacken	600
			Suchet	3,027		
19–20	Melpomene	2,950	Tage	7,045	Admiral Korniloff	5,000
	Magicienne	2,950	Cecille	5,766		
	Marathon	2,950	Isly	4,160		
			Lalande	1,877		
			Jean Bart	4,160		
			Alger	4,123		
			Mogador*	4,325		
			Coetlogon	1,850		
			Cosmao	1,850		
			Surcouf	1,850		
			Forbin	1,850		
			Tronde	1,877		
18–19	Iris	3,730	Milan	1,540		
	Mercury	3,730	Bombe	320		
	Mersey	3,550	Couleuvrine	320		
	Severn	3,550	Dague	320		
	Thames	3,550	Dragonne	320		
	Forth	3,550	Flèche	320		
	Grasshopper	450	Lance	320		
	Rattlesnake	450	Sainte Barbe	320		
	Spider	450	Salve	320		
	Sandfly	450				
	Sharpshooter	450				
17–18	Polyphemus	2,640	Condor	1,280		
	Alacrity	1,400	Epervier	1,280		
	Surprise	1,400	Faucon	1,280		
	Amphion	3,750	Vautour	1,280		
	Arethusa	3,750				
	Leander	3,750				
	Phaeton	3,750				
	Archer	1,630				
	Cossack	1,630				
	Tartar	1,630				
	Fearless	1,430				
16–17	Shah	6,250	Duquesne	5,800		
	Inconstant	5,780	Tourville	5,600		
	Brisk	1,630	Sfax	4,488		
	Mohawk	1,630				
	Porpoise	1,630				
	Serpent	1,630				
	Racoon	1,630				
	Scout	1,430				
15–16	Raleigh	5,200	Duguay Trouin	2,300	Vitiaz	2,950
	Bacchante	4,130	D'Estaing	2,400	Rynda	2,950
	Volage	3,080	Nielly	2,300		
	Active	3,080	Dupetit Thouars	2,000		

* Date of commencement uncertain.

Unarmoured and Protected Cruisers—*continued.*

Speed.	England.		France.		Russia.	
	Name.	Displacement.	Name.	Displacement.	Name.	Displacement.
Knots.		Tons.		Tons.		Tons.
15–16	Curlew	785	Seignelay	1,900		
	Landrail	785	Sané	1,900		
			Eclaireur	1,830		
			Hirondelle	1,040		
14–15	Boadicea	4,140	Aréthuse	3,400	Zabiyaka	1,234
	Euryalus	4,140	Dubourdieu	3,400	Bobr	950
	Rover	3,460	Iphigénie	3,200	Pamyat	3,050
	Buzzard	1,140	Lapérouse	2,400	Merkuriya	
	Daphne	1,135	Magon	2,300	Sivuz	950
	New Buzzard	1,140	Roland	2,300		
			Villars	2,400		
			Champlain	2,000		
			Château Renault	1,850		
			Desaix	1,700		
			Primauguet	2,400		
			Rigault de Genouily	1,710		
13–14	Calliope	2,770	Infernet	1,936	Kreyzer	1,542
	Calypso	2,770	La Clocheterie	2,000	Oprichnik	1,426
	Cleopatra	2,380	Fulton	825	Nayezdnick	1,334
	Curaçoa	2,380	Inconstant	825	Strjelok	1,343
	Conquest	2,380	Naiade	3,500	Afrika	2,852
	Constance	2,380	Papin	825		
	Champion	2,380	Forfait	2,400		
	Cordelia	2,380				
	Canada	2,380				
	Caroline	1,420				
	Satellite	1,420				
	Heroine	1,420				
	Pylades	1,420				
	Hyacinth	1,420				
	Rapid	1,420				
	Royalist	1,420				
	Emerald	2,120				
	Opal	2,120				
	Garnet	2,120				
	Amethyst	1,970				
	Sapphire	1,970				
	Encounter	1,970				
	Briton	1,860				
	Dido	1,760				
	Swallow	1,130				
	Bramble	670				
	Lizard	670				
	Rattler	670				
	Partridge	755				
	Peacock	755				
	Pheasant	755				
	Pigeon	755				
	Pigmy	755				
	Plover	755				

SUMMARY.

CRUISERS, BUILT AND BUILDING.

	Knots .	Over 19	18–19	17–18	16–17	15–16	14–15	13–14
Total number	England .	5	11	11	8	6	6	34
	France .	15	9	4	3	8	12	7
	Russia .	3	..	..	..	2	4	5
Total displacement	England .	14,450	23,910	26,760	21,610	17,060	15,155	55,700
	France .	49,814	4,100	5,120	15,888	15,670	29,060	12,311
	Russia .	6,200	..	..	..	5,900	6,184	8,497

We may properly include in our fleet for the protection of commerce the seven belted cruisers, 5000 tons, 18 knots speed, and the Imperieuse and Warspite, each over 16 knots speed, and of 8000 tons. The armoured cruisers of Russia are not of modern type, and their speed is not equal to recent requirements.

Resources for ship-building.

Having given a list of the ships of the two powers upon whose preparations the attention of English statesmen is chiefly concentrated, it may seem almost superfluous to point out that it is not alone or chiefly by a comparison of ironclads, cruisers, and guns, built or projected, that naval power is to be measured. The true standard by which we may gauge our own strength and that of possible enemies was laid down in the statesmanlike speech made by M. Menard Dorian, in the discussion on the French Navy Estimates, in the Chamber of Deputies, on the 20th January, 1887. "Picture to yourself," he said, "the results of the first encounter between hostile fleets! Most terrible assuredly they must be, with the means of destruction which science has placed at the command of the Navy. It is probable that both sides will be but ill-prepared to renew the engagement. The survivors from the first struggle will be too few to resume the combat. With whom then will the supremacy over the seas remain? With the nation possessing the largest industrial resources; with that power which shall be the first to replace the fleet destroyed by the rapid construction of a new fleet. Therefore it is that the real strength of England lies, not in her dockyards, not in her public establishments, but in the combined creative resources of her private shipbuilding yards. Those yards occupy a position more secure from attack than ours. But we cannot trace anew the coasts

M. Menard Dorian.

of France. It is not in our power to create seaports like those of England far up navigable rivers, combining facility of access from the sea, with the advantages for the purposes of defence of an inland position."

Rapid completion of ships built by contract.

In the rapid completion of the ships ordered in 1885, a conspicuous example has been shown of the recuperative power of England. An ironclad of the largest class will be completed in less than four years by a firm never before engaged upon a similar construction. Our noble fleet of belted cruisers will have been completed in little more than two years from the day when the orders were given. From a single yard, not possessed of at all exceptional resources, whether in capital or in plant, six vessels of the Archer class, 1630 tons, 3500 horse-power, have been turned out in eighteen months. Fifty torpedo boats were built by two firms in six months.

Loss of individual energy and enterprise from sale of works to companies.

It may be acknowledged that while our shipbuilding yards have responded with such remarkable vigour to a large and sudden demand from the Government, the capabilities of British industry for the supply of armour and the materials required in the manufacture of ordnance have left something to be desired. If the general development of the metallurgical industry in France is less than with us, production is concentrated in a few splendid establishments. We have nothing in this country which will compare with the great organisation at Creuzot, or that of Krupp in Germany. The reason is not far to seek. Men of enterprise who have succeeded in building up great concerns in England have been moved, by family considerations, to seek relief from the hazards of business by the sale of their works and foundries to joint stock companies. In its application to manufacturing or industrial organisation, corporate must generally be inferior to private enterprise, both because the strongest incentives of personal responsibility, ambition and self-interest are wanting, and because it is seldom conducted with that ample command of capital which a wealthy and enterprising proprietor is able to supply for the trial of inventions, the improvement of machinery, the extension of workshops and plant. The shareholders in a joint stock company may be presumed, for the most part, to be people with whom a call for an additional subscription is unpopular. If the great ironworks founded by Armstrong, Cammell, Brown, Firth, Whitworth, and others, had remained in the hands of individual capitalists, we should probably have been in a better position to compete with Creuzot and Krupp. The Government would do much to remove the difficulty by looking far ahead, and giving contracts for materials extending over longer periods than at present.

Mercantile tonnage.

Viewed in connection with the remarks of M. Menard Dorian the comparative tonnage of the Mercantile Marine may be taken as a sure indication of the inherent power of the Empire for naval warfare. The coaling stations, graving docks, repairing establishments, building yards, engine factories, ironworks, coal pits, the skilled labour in building ships, the experienced officers and seamen who man them, all the resources, in short, for creating, repairing, and manning a fleet are in a large degree proportionate to the tonnage of shipping built and kept up in the several countries. The Government and the country may neglect the duty of organising those resources for the national defence. But the ability to equip and man a fleet for commerce implies and includes the power to send forth ships of war. The principal statistics of the shipping trade were brought together in the article published in the *Times* of December 30.

In 1877, the tonnage on the British register amounted to 6,336,000 tons. In 1886, it had risen to 7,321,000 tons. Within the same period the steam tonnage increased from 2,000,000 tons to 3,969,000 tons. We have now 67 per cent. of the steam tonnage of the 14 principal maritime countries as against 8·3 per cent. for France, 7·2 for Germany and 1·7 for Russia.

Manning of the Navy—Resources in the Mercantile Marine.

Inscription Maritime.

When we turn from the ships to the relative resources for manning, the French have the advantage of a compulsory service under which 100,000 men are enrolled. The late M. Gabriel Charmes, in his essay, 'La Réforme de la Marine,' gives a far from favourable impression of its practical maritime value as a resource for manning the Navy. His argument may be paraphrased as follows:—"In the present conditions of naval warfare, does any one believe that it will be possible to pass from a fishing-boat, or even from a steamer, to a vessel of war, and to handle modern guns and torpedoes, without long preliminary training? Sail power will be reduced to nothing, or next to nothing; a top-man's rating will become the lowest in the service. Were it then necessary to return to Colbert's idea, to adapt it to the necessities of modern times; were it wished to secure for the service of the Navy that portion of the population best adapted by ordinary occupations and habits of life to naval warfare; it would no longer be to the inhabitants of our coasts that the 'Inscription Maritime' would be extended. The artisans in our factories, the mechanics in our railways and in our industries; the new classes, brought up in yards where machines are made and worked, would be far more useful in our ships than men whose sole qualifications are to handle sails and climb masts. It is, however, quite clear that the great manufacturing interests of modern days would require more tender handling than the maritime trade received in former times at the hands of Colbert."

In England popular feeling is against compulsory service. The State is compensated by the fine spirit which fills the ranks of the Volunteers and the Naval Reserves, and yields a never-failing supply of recruits for the Navy. To that vast body of seamen, mechanics, engineers, and stokers, employed in the Mercantile Marine we shall never look in vain. When the mercantile auxiliaries were taken up the other day in anticipation of war with Russia, to a man the officers in the engine-room and the soot-begrimed labourers in the stokehold volunteered for the service of the country in war.

Engineers.

The steam tonnage under the French flag being comparatively limited, the supply of engineers for the fleet has never yet on an emergency been found sufficient.

Executive officers.

The difficulty which has been experienced in the supply of engineers is felt in other ranks of the Navy. In the late war with China, M. Gabriel Charmes affirms that the French Navy was absolutely short of officers, even though the service at home was denuded in order to send as many as possible to China.

Late retirement in French service.

M. Weyl complains of the want of a liberal system of retirement in the French Navy. "We have," he says, "many officers past work upon the staff of the Navy. In the Queen's ships you never see men of advanced years in subordinate positions. So much certainly cannot be affirmed of the French Navy."

Finances.

It is a mere truism to say that elasticity in financial resources is an essential element in naval strength. The financial question has assumed an increased importance, in relation to naval preparation, since the introduction of the costly ships and weapons of the modern Navy. This result was anticipated a generation ago by Admiral Paris, the well-known author of the *Art Naval.* "This examination of the shipbuilding problem under the new conditions was," he says, "sufficient to show the financial abyss to which maritime war, aided by steam power, is leading us, especially since the introduction of armoured vessels has given greater importance to the expenditure of money, as compared with the loss of human life, and has to that extent separated us more and more from the condition of the savage, who can fight without expense, because his only weapons consist of the spear and the arrow. The general result is that the further we go the more will naval war be waged with money rather than with men. Is this a benefit? Let us hope that it is."

Admiral Paris. *L'Art Naval*, p. 23.

The result of a straitened as compared with a well-supplied exchequer is seen in the fall of the French Three per Cents. to 82, while the British Three per Cents. are above par. The total revenue of France for 1886 was lower by 71,311,000 frs. (£2,852,440) than the estimates, and 31,895,000 frs. (£1,275,800) lower than that of 1885.

In more than one debate on the position of the Empire, Lord Beaconsfield insisted on our financial strength as a main source of our commanding influence abroad. Speaking in the House of Commons in 1867, he said: "When it is known that the garrisons of England are strong, that her fleets are commanding, no doubt these are sources of respect and influence for us in foreign Courts. But allow me to say that there is another great source of influence . . . which has arisen from this circumstance, that England is the only country which, when it enters into a quarrel that it believes to be just, never ceases its efforts until it has accomplished its aim. . . . Well, what gave us this power, when there was not a State in Europe which could enter into a third campaign? It was the financial reserve of England. . . . You may have your garrisons at foreign ports, and your fleets of commanding power, but if you have also omitted the principal cause of your power, viz., a sound state of your finance, you may find you have omitted one of the most important elements of your influence abroad."

Expenditure on ship-building.

The administrators of the French Navy have been compelled to yield to the financial exigencies of the country. The number of workmen in the dockyards, increased to 24,500, for the successive expeditions to Tunis, Tonkin, and Madagascar, is being brought back to the normal strength of 22,000. The great Squadron of Evolution, the only ironclad fleet in commission in the French Navy, is reduced to four ships attended by one despatch vessel. While these reductions have been taking place in France, the progress of naval construction in England is shown in the Table, presented to Parliament with the expense accounts for the year 1885–86:—

Year.	Dockyard.	Contract.	Machinery.	Total.
	£	£	£	£
1880–81 . . .	891,388	235,920	299,041	1,426,349
1881–82 . . .	1,149,78	292,243	240,539	1,682,500
1882–83 . . .	1,173,816	301,159	292,039	1,767,014
1883–84 . . .	1,186,793	235,913	507,384	1,930,090
1884–85 . . .	1,333,607	449,421	459,042	2,242,070
1885–86 . . .	1,183,588	1,550,362	1,003,511	3,737,461
1886–87*. . .	1,479,927	1,430,200	746,000	3,656,127
1887–88*. . .	1,473,552	1,016,753	567,950	3,058,255

* Estimated as shown in the programme of construction in the Estimates.

Efficiency of administration.

Turning to the relative efficiency of dockyard administration in France and in England, if we must acknowledge that many things are less perfect than we could wish, the same evils are seen, perhaps in a more aggravated form, in the public establishments abroad. If we are overburdened with a clerical staff, the French dockyards are crowded with a still larger body of non-producers. It was stated by M. Maurel, deputy for the Var, in his speech on the Navy Estimates, that while the total numbers employed in the French dockyards, from the Prefect Maritime down to the watchman, were 31,213, the clerical establishments, commissariat, works department, hospitals and police, represented a total of 7282 as against 23,931 working hands.

If, again, under a system of payment by time we fail in developing the full capabilities of our workmen, the same fatal system produces lethargy in France. That acute critic of the British Navy, M. Weyl, has some remarks on this subject which were recently quoted in the *Army and Navy Gazette*:—

"It is indispensable in the interests of the public purse that the number of the workmen in the naval ports should be reduced. There are several thousand more in France than in England, and it is no mystery that the workmen in our arsenals do not shine by their ardour. No one can visit our naval ports without being struck with the lazy manner in which the slightest work is carried on. Every time that extra hands are employed, there is great difficulty in getting rid of them; first there is the question of humanity, and then there is the 3 per cent. which is deducted from their salaries for the pension fund."

If, lastly, our shipbuilding, criticised with the professional knowledge, the acuteness, and the indomitable persistency of a Sir Edward Reed, is made to appear an unbroken chronicle of failures and misconceptions, there are failures also in the naval architecture of France. It would be invidious for a foreign critic to give examples. In the debates on the French Navy Estimates criticism is as unsparing as with us. Lastly, if our ships have been built slowly, those of our neighbours have occupied at least one-third longer in construction. On the whole, the British taxpayer may rest satisfied that expenditure secures at least as good a return in English dockyards as in French.

Armaments.

In the armament of our ships comparisons with other powers are less satisfactory. We have in our new 111-ton breechloaders a gun without a rival; but our available supply of heavy breechloaders is still lamentably insufficient. We have a considerable supply of effective light breechloaders; we have a large number of muzzleloaders, of heavy calibre, but, from the inferiority of range, penetration, and quickness of firing, now almost obsolete weapons. The delay in adopting the breechloading system for the British service is much to be regretted. We have to face a large expenditure to bring our store of guns to a level with our great requirements.

Naval stations abroad.

England possesses in her numerous stations abroad excellent bases for the Navy. The Admiralty, to quote from M. Weyl, "has concentrated considerable resources in these places for the repair of the fleet, and as they are also commercial centres of high importance, the private trade is in a position to render the greatest services to the Navy. The work executed at Hong Kong for the French Navy in the first period of the recent French campaign in China is fresh in our recollection. Our ships were re-fitted and repaired as easily as in the great harbours of France. When the English Government, as a neutral power, refused to receive our vessels, and we were compelled to fall back on our own resources for repairs, it was found that the arsenal, imperfectly fitted at Saigon, immediately after the conquest of that dependency, had been neglected ever since. The greatest exertions were made, but after the blockade of Formosa numbers of our ships lay in the anchorage at Saigon unfit to take the sea. For any power not possessing the numerous stations at the disposal of England the difficulty of coaling in many parts of the globe would be almost insuperable."

Imaginary descriptions have been lately given in widely-read pamphlets of a successful invasion of England. That undertaking, says the historian Lanfrey, did not commend itself so readily to the judgment of Napoleon:—

Napoléon Ier. Lanfrey, p. 352.

"Le général Bonaparte n'avait jamais pris au sérieux le projet de descente en Angleterre. "Il savait qu'il aurait affaire en ce pays à une race d'hommes toute différente de celle qu'il avait eue à combattre en Italie, et que s'il n'était pas facile de pénétrer dans cette île fameuse, contre laquelle s'étaient tant de fois brisés nos efforts, il le serait encore moins d'en sortir. "L'expédition d'Égypte n'exigeait pas le lent et périlleux labeur auquel l'eût condamné la tâche ingrate de dompter la fière Angleterre."

Having briefly reviewed the position of the British Empire in relation to the resources and foundations of naval power, it is evident that if we have great interests to defend, and much treasure exposed to capture, the means are not wanting if we wisely use them, for giving security to every part of the Empire. Our history in the past portends a not inglorious future built upon fruitful enterprise and upon noble principles of freedom. "We have never," says Sir Henry Maine, "lost a battle in Europe, or a square mile of territory. We have never taken a ruinous step in foreign politics. We have never made an irreparable mistake in legislation." We shall do well to be cautious, but there need be no misgivings. Let us be just and fear not, always observing the wise maxim of Thucydides, that "to do no wrong to a neighbour is a surer source of strength than to gain a perilous advantage by the exercise of arbitrary power."

CHAPTER XII.

THE MOSQUITO FLEET.

ARMED BOATS AND VESSELS OF SMALL SIZE.

BEFORE the year 1863 no ship of war carried a boat propelled by steam. Launches, pinnaces, cutters, and all other boats forming the equipment of a war ship were propelled by oars and sails.

In 1863, at the suggestion of English marine engineers—Messrs. Humphrys were perhaps the first in the field—42-ft. launches were fitted with propelling machinery, and soon afterwards the French adopted, for use in their ships, powerful steel towing launches.

It was foreseen that the cost of maintaining a navy would be seriously affected by an innovation which might not improbably lead to the complete substitution of steam power for manual and sail power in a service where no corresponding economy in men or time could be looked for. The men could not be reduced in numbers, and the saving in their time had no money value.

It was not possible, however, to allow this country to remain a passive spectator while the fleet of a foreign power was thus equipped with boats propelled by steam. Boats built of wood, and varying in length from about 21 ft. to 56 ft., and in speed from 6½ to 15 knots, were produced in great numbers. They were supplied to every ship in the service, and form an essential item in the naval stores at every depot.

The principal and most highly valued types have been the creation of Mr. J. S. White of Cowes. The larger classes are indifferently armed both with guns and spar and Whitehead torpedoes, and may be styled either gun or torpedo boats. The steamboats of wood are of various dimensions, including cutters, pinnaces, launches, and torpedo boats. The higher rates of speed have only recently been obtained by adopting the principles of the steel "torpedo boat."

Improvements in speed have had the usual effect of discrediting the earlier and slower classes. A 52-ft. steam pinnace with 120 lbs. steam pressure, with compound engines, forced draught, and a locomotive wet firebox boiler, has obtained a speed of 15 knots on the measured mile with 134 horse-power. A steam pinnace 56 ft. in length has obtained a speed of 15 knots with 150 horse-power. Previous to the year 1878 the indicated horse-power for the 42-ft. boat had not exceeded 50, and the highest speed which had been obtained was 8½ knots.

The torpedo boat has a more recent origin. Ten years ago we had none in the British Navy. Very fast boats, too long to be carried in ships, had been built by Mr. Thornycroft for Foreign Governments. They excited the greatest possible interest, and the general introduction of boats of a similar type into the British Navy was keenly debated. Naval officers who were consulted were averse to their use. They believed them to be too fragile for practical service. No doubt, however, was entertained as to the necessity of adopting the Whitehead torpedo for the general armament of the Navy.

In 1874 the first torpedo vessel, the Vesuvius, had been launched. She was of 245 tons displacement, had a speed of 9¾ knots, and cost the same as a modern torpedo boat, *i.e.* about £18,000. Her torpedo discharge was submarine. She was designed to offer as small a mark as possible, and she had no funnel; but the difficulty in lighting fires in a vessel constantly employed for training purposes at home caused this plan to be abandoned, and a funnel was subsequently fitted.

Further experience at home and abroad overcame all objections, and led to the introduction of the Thornycroft type. In 1878 the Lightning, 86 feet long, and of 18 knots speed, was added to the British Navy. Naval officers were very soon satisfied with this type of vessel, and under the influence of public opinion abroad the demand for torpedo boats, which begun in foreign countries, was strongly pressed in the British Navy.

It was in England that a demand first arose for a shorter type which could be carried in ships, and which should have a hoisting weight not exceeding eleven or twelve tons. But these boats, useful as they would probably be in war, have until recently been discredited by the Navy. A more extended experience has led to a change of opinion. The torpedo flotilla of the immediate future will probably be constituted of two classes. The larger class will be of sufficient size to hold the seas in all weathers. The smaller class will be of a size suitable for hoisting on board ship.

Submarine boats are talked of seriously, and the second-class torpedo boat, as carried in most large British ships, cannot be condemned as being an impracticable weapon.

French ships do not usually carry boats of this type, because the nature of the armament of the ships makes it impossible to stow and handle them. The French Government are however fully alive to the value of ships like the Hecla forming depots for such boats. They are becoming an essential type in their squadrons, under the new designation of Mères-Cigognes.

The Mosquito Fleet is represented by various types in different countries. The latest Thornycroft torpedo boat, the Ariete, built for the Spanish Government, made over 26 knots measured mile speed.

Of the various classes of torpedo boats the British Navy possesses the following :—

FIRST-CLASS TORPEDO BOATS.

No.			
19	of about 85 ft. in length,	28 tons displacement,	and of 350 to 500 I. H.-P.
2	„ 100 „	40 „	„ „
4	„ 110 to 113 ft. in length,	63 to 67 tons displacement,	and of 750 I. H.-P.
53	„ 125 ft. in length,	60 to 85 tons displacement,	and of 750 I. H.-P.
1	„ 135 „ (Falka type.)	87 tons displacement,	and of 1320 I. H.-P.
1	of about 150 ft. „ (late Swift.)	137 „	„ „
—			
80			

SECOND-CLASS TORPEDO BOATS.

50 from 60 to 66 ft. in length, 12 tons displacement, and 100 to 140 I. H.-P.

TORPEDO BOATS (WOOD).

9 of 56 ft. in length, 11 tons displacement, and 150 I. H.-P.

Such are the facilities for building torpedo boats in Great Britain that it may be confidently asserted that 100 first-class, and a still greater number of second-class boats could be produced in six months.

The larger classes of these vessels are capable of operating defensively against the smaller. The vessels built recently for the Navy by Thornycroft, Yarrow, and White, were designed for a gun armament to be employed against the boats armed with torpedoes, which would have beset a British fleet in the Baltic had we been at war with Russia.

Torpedo catchers.

A much larger class of vessel has come into existence for preying upon the Mosquitoes, sometimes called torpedo boat-catchers, or more recently torpedo gunboats. This class is represented by the Bombe in the French Navy, the Rattlesnake in the British Navy, the Wiborg in that of Russia, the Destructor in that of Spain, and the Tripoli in that of Italy.

Their dimensions are as follows:—

	Bombe. (French.)	Rattlesnake. (British.)	Wiborg. (Russian.)	Destructor. (Spanish.)	Tripoli. (Italian.)
	ft. in.	ft. in.	ft. in.	ft. in.	ft. in.
Length	196 10	200 0	142 6	192 6	230 0
Breadth	21 7	23 0	17 0	25 0	26 0
Draught of Water . . .	5 11	8 0	5 2	7 0	10 5½
Displacement	320	450	167	458	831
Indicated horse-power . .	1800	2700	1400	3800	3016
Speed in knots	18·	19·	18·55	20·2	19·8
Tons of coal (normal) . .	..	50	14	37	..

The dimensions most suitable for the class intermediate between the Mosquito Fleet and the Archer can only be determined, as it has been said, by trial at sea. The Bombe class are fragile and weakly defended as compared with the Scout and Archer. They have no advantage in speed over the Mosquito types; and they are far more costly. It must be admitted that the Mosquito types cannot keep the sea, and that a larger type is essential. It has yet to be established that the dimensions of the Rattlesnake are adequate.

The progress made in torpedo boats in Foreign Navies is thus ably summarized, in the Report of the Bureau of Navigation at Washington, June 1887:—

"The impotence of a boat fitted with only bow tubes was emphasized in an attack made on the Richelieu off Toulon in October 1886. There was a moderate breeze and sea from north-west: the Richelieu, with her nets down, maintained a speed of about 4 knots, while torpedo boat No. 26 (108 ft. long, 45 tons displacement) manœuvred to attack. Although the circumstances were not especially unfavourable, the boat's bow tubes were constantly submerged when head to sea, and she had finally to be given an opportunity of discharging her torpedo to leeward; this was done at a distance of 200 metres, and the target, 322 ft. long, was missed, owing, it is said, to the boat making a sheer at the moment of firing.

"It is said that the French Naval authorities at Toulon have succeeded in devising an efficient tube-closer, which is shot away with the torpedo, and by which, therefore, the tube may be kept closed in action.

"This difficulty in obtaining bow-torpedo fire has otherwise been obviated in a design of Mr. Normand, in which the tubes, still remaining parallel to the middle line, are brought aft to abreast the conning tower, one on either side, and raised. The direct fire ahead is thus effected in much the same way as gun-fire from the sponsoned half-turrets of larger vessels.

"In the course of the past year Schichau has yielded to Thornycroft the honour of producing the fastest vessel in the world, the owner now being the Spanish Admiralty in place of the Russian. The boat thus distinguished is the Ariete; speed 26·18 knots.

Austria. "The Habicht, a 90-ton boat, built by Schichau for the Austrian Navy, made 21·77 knots for three hours, or 1¼ more than required by contract. It is understood that future torpedo boats will be much larger, approaching 300 to 400 tons displacement. The Naval Budget for 1887 provides 720,000 florins for torpedo boats and vessels.

China. "A 128-foot boat built by Yarrow for China made 23·88 knots on the measured mile, and averaged 22·94 for two hours, carrying full equipment and complete weight of armament, but not quite full supply of coal. Her displacement is 69 tons; triple-expansion engines; locomotive boilers; diameter of turning circle less than two lengths.

"A large boat built by Schichau, 144 ft. 4 ins. long, 16 ft. 5 ins. beam, 7 ft. 6½ ins. draught, steamed from Elbing to Foochow in the fall of 1886, arriving in good condition. On trial in the Baltic she made 24·23 knots for one hour, carrying coal for 1000 knots. With coal for 3000 miles an average of 22·5 was maintained for four hours.

France. "The evolutions of 1886 convinced the French Naval authorities that the 33-metre type of torpedo boat, while efficient for harbour defence, is too small to be considered as an 'autonomous' sea-going craft. The consequent policy is to build larger ones.

"Furthermore, Admiral Aube, the Minister of Marine, has taken into consideration the project of torpedo-supply vessels on a greater scale than has been the case in other Admiralties. The plan is apparently to build for this purpose three coast-defence vessels to carry a belt of 14 inches of armour, a 2¾-inch protective deck and a central redoubt with 12 inches of armour; to have a battery of two 13½-inch guns, besides revolving and rapid-fire guns and torpedo-tubes, and be fitted with torpedo nets. These vessels are intended to carry a large supply of spare torpedoes, ammunition and coal, and a plant for executing repairs, and each will accompany a division of six torpedo boats.

"Three 134½-foot boats, the Balny, Déroulède, and Doudart de Lagrée, have been completed by Normand. They carry two tubes forward and two 37-millimetre H. R. C. The machinery comprises independent air, feed, and circulating pumps, the latter having to be started only when the boat is at rest, as, when under way, the condenser surfaces are cooled by the passing water. The maximum trial speed was 20 knots; when loaded they made 19 knots. The coal endurance is about 1300 miles at 12½ knots, and they carry two canvas collapsible boats, one on deck and one below. In the quarters canvas is stretched a short distance from the skin to form an air-space, but this is said not to be efficacious in reducing the heat. They behave satisfactorily at sea, being a great improvement on the 108-foot boats, but still do not appear to be popularly considered as 'torpilleurs de haute mer.' Six more of the same class are in various stages of construction in different yards.

"The first of the 35-metre type (114¾ feet) was launched in January 1887, and the recent Naval Budget provides for 24 more first-class boats, which will not be begun, however, until those now building are tried. Money was also voted to build eight of the Ouragan type, which also will not be begun until after her trials.

"The Ouragan, laid down in the summer of 1886, is spoken of as a 'contre torpilleur,' on account of her increased size and the armament of two 47-millimetre H. R. C., which she is to carry. She was designed by the 'Ateliers et Chantiers de la Loire,' and built by the same company, at Nantes, as a speculation, the Minister of Marine afterwards agreeing to purchase her if the expectations and promises of the company were realized. The principal dimensions are: Length, 151 ft.; beam, 15 ft. 9 ins.; draught, 8 ft. 4 ins.; displacement, 148 tons. The speed is expected to be 25 knots; the contract calls for 22, with a premium for excess, and the stipulation is made that the boat shall go from Nantes to Toulon without stopping. There are two locomotive boilers, supplying steam to a single 4-cylinder engine which works with quadruple expansion at ordinary speeds and triple expansion for full power. The torpedo armament consists of two tubes forward, 5½ ft. above water, and two on deck, each on a movable carriage which can be run on tracks from side to side; as the sides do not tumble home, the latter can be trained well forward and aft.

"The 'Forges et Chantiers,' La Seyne, have built some very successful vedette torpedo launches, 41 ft. long, 7 ft. 5 in. broad, 3 ft. 7 in. draught, displacing 7 tons. They have made a speed of 14·18 knots over the measured mile; the average for three hours was 12 knots.

"Among the German torpedo boats, those built by Schichau are most highly spoken of, on account of their seaworthiness, speed and economy; greater beam in proportion to length, coupled with the ability to run the engines at greatly reduced speed, contributed to Germany.

their good behaviour in a sea-way, the speed being made up by greater engine power. They also have straight stems and do not carry such a big *bone* as those of many other builders in different countries, and can consequently fire the bow tubes with greater safety and precision.

"The two 220-ton 'division torpedo boats' have been completed; they are 185·3 ft. long, 21·6 ft. in beam, with 9·8 ft. draught. They are to be fitted with tubes like the 90-ton boats, but their main work will be to form a movable base for a division, being roomy and provided with a plant for making repairs, also medical facilities, and spare men, torpedoes and gear. Their armament will be six 37-millimetre H.R.C.

Italy. "The four 90-ton Schichau boats built for the Italian Admiralty have been delivered, having exceeded the contract speed (21 knots) by 1¼ knots. One of them collided with her consort and sank off the Spanish coast while on their way to the Mediterranean.

"The two 140-foot twin-screw boats built by Yarrow have been completed and tried, one averaging 24·964 knots for six runs over the measured mile, and the other 25·1 knots, the greatest speed that had been attained by any vessel up to that time. Their beam is 14 ft., draught 5 ft. 4 ins., displacement 100 tons. They have two locomotive boilers, one forward of and the other abaft the engine-room, both of which can furnish steam to either or both engines, which are compound. The centrifugal circulating pumps can draw from any compartment, besides which there are ejectors and hand pumps for each compartment. There are ten water-tight bulkheads, and Yarrow's patent arrangement is fitted for preventing the fires being extinguished by water rising in the fire-room.

"Double steam steering gear is fitted to work the forward and after rudders independently of each other. The torpedo armament consists of two torpedo-tubes forward in line with the keel, and four on two turntables, those of each pair making a small angle with each other to increase the chances of a hit in firing both together; two 3-pounder rapid fire Nordenfelts are also provided, and a search light.

Japan. "A large twin-screw Yarrow boat, 166 ft. long, 19 ft. broad, has been completed and shipped in sections to Japan. She has two boilers which, with the engines, are protected by 1-inch steel armour. There are six torpedo-tubes, two forward in line with keel, and the rest in pairs on turntables, those of each pair forming a slight angle with each other. Four machine-guns are also provided. The speed is said to be 19 to 20 knots.

Russia. "The nine 90-tonners ordered of Schichau for the Russian Government in December 1885, were completed in the summer of 1886, and proved highly successful in point of speed, endurance, and seaworthiness. Their length is 125 ft. and draught 11½ feet, when loaded to the full 90 tons displacement. On the trials, on about 85 tons displacement, all made over 21 knots, all but one made over 22, and several made 23 knots an hour. They have five complete bulkheads and one half-bulkhead forward, a 14-ton ejector in each compartment, and steam steering gear to work forward or after rudder independently. The armament consists of two tubes forward in line with the keel, dipping downward 2½ degrees, and four 37-millimetres R.C. One steel and one canvas boat are carried.

"Normand has built two 100-ton 154-foot boats for Russia, the Sweaborg and Revel. The latter averaged 22 knots at the trials.

"The Wiborg, built by J. & G. Thomson, completed her trials in October 1886. This is a twin-screw boat, 142 ft. long on the waterline, 17 ft. beam, load displacement 167 tons. The hull is very much rounded above water, and has a long sloping bow covered with ¼-inch plating. There are 23 water-tight compartments, and forward, in the vicinity of the water line, there is an inner skin leaving a cellular space that can be filled with water-excluding material. The ten ejectors can discharge 1500 tons in one hour, and the centrifugal circulating pumps will draw 300 more. The engines are vertical compound, supplied with steam from two boilers, each of the latter being in a separate compartment, and the whole being surrounded by protective coal. Steam starting gear is fitted to ensure rapid reversal of the engines. The bunkers hold 45 tons, which will last for 4000 miles at 10 knots. The armament consists of two 47-millimetre revolving cannon and six 19-foot torpedoes, which will be fired from two tubes forward and one revolving amidships. The interior is lighted by incandescent lamps, and a 12,000 candle search-light is fitted on the conning tower. The following mean speeds were realized in 3-hour trials: Displacement 131 tons (carrying 34 tons), speed 20·6; displacement 138, speed 19·96; with load displacement of 167 tons, ready for sea, speed 18·55; with one screw going and one dragging, 17 knots was made; with both engines and one boiler, 17½ knots; full speed astern, 16 knots.

"Spain has now the fastest torpedo boat in the world, a speed of 26·18 knots having been attained in the trials of the Ariete, a 147½-foot boat built by Thornycroft. Another of this size is in course of construction, to be named the Rayo; they have 14½ ft. beam and 4 ft. 9 ins. draught, and are propelled by twin screws; the armament consists of two torpedo-tubes and four machine-guns. Spain.

Yarrow has two boats in hand, the Halcon and Azor, 134½ ft. long, 14 ft. beam, to make over 23 knots and to carry the same armament as the Thornycrofts.

Turkey.

"The Turkish Admiralty patronises all markets for torpedo boats, including its own dockyards. At Constantinople there are building four boats, 100 ft. 4 ins. long, 11 ft. 9 ins. beam, to make 19½ knots; also a 140-foot boat, 16 ft. broad, 6 ft. 10 ins. draught, 110 tons displacement, to make 23 knots.

"The Germania Company, of Stettin, have in hand nine boats, 121 ft. 4 ins. long, to make 22 knots.

"A 126-foot boat has been completed by Maudslay Sons & Field; it has 15 ft. beam, and averaged 21·7 knots at the trials, the maximum being 23·4.

United States.

"On the 1st of July, 1887, the United States will own a torpedo boat, the Stiletto. Her load displacement is 35·65 tons, of which 9·2 tons are weight carried. After deducting for 10 men, 1 boat, 2 tubes, 3 torpedoes, a 39-millimetre H.R.C., and 600 rounds for it, there would be left 4 tons for coal; 3 more tons will only bring her down 2 inches more, and the total, 7 tons, will carry her about 300 miles at 19 knots. The hull is divided into six water-tight compartments, from all of which, except the two end ones, water can be drawn by an ejector.

"On July 3, 1886, six runs were made over the measured knot, on a displacement of about 28 tons, the wind being fresh and the water rough. The true mean of the six runs was 22·898 knots, which exceeds any speed ever attained by a boat of that size. During another trial, six half-circles were made, the average time being 41 seconds to starboard and 47 seconds to port. The heel was not great in turning.

"The essential features of the Stiletto, regarded as a torpedo boat, may be summed up as follows: being built with a wooden skin, she is not heated up to such an intense degree as the steel boats, and less water would enter through machine-gunshot holes; the economy is great, and the speed satisfactory and well-sustained; the firemen can easily escape from the closed fire-room; the type of boiler (Herreshoff coil) is good, as the amount of steam to escape, if penetrated, is small, while it can be forced to any extent.

Nordenfelt submarine boats.

"The Nordenfelt, a submarine torpedo boat, launched in March 1887, at the Barrow Shipbuilding Company's Works, is the largest and most powerful ever yet constructed. The length is 123 ft.; beam, 12 ft.; depth, a little over 12 ft.; displacement wholly immersed, 243 tons. The upper part of the turtle-back is plated with one-inch steel, as are also the two conning towers. Steam at 150 pounds pressure is supplied by two large multitubular boilers to two pairs of compound engines driving a four-throw crank-shaft and single screw. There are also other engines for sinking, steering, circulating, pumping, driving fans, &c. The reservoirs and boilers hold enough superheated steam and water to propel the boat 20 miles with the fires out. The ordinary coal capacity is 8 tons, which will drive her 1000 miles at 8 knots; 20 tons can also be stowed in the three cold-water ballast tanks. In a recent preliminary trial, a speed of 6 to 8 knots was attained with fires out and only the two turrets showing; with a less displacement, and steam up, she made about 13 or 14 knots. There is an apparatus by which the speed of the two vertically-placed screws which pull the boat down under water, may be increased or decreased independently, to keep her in a horizontal position. The offensive power is vested in two tubes and four fish torpedoes, and for defence she will carry two Nordenfelt guns."

CHAPTER XIII.

MERCHANT STEAMSHIPS.

Atlantic steamers.

THE first steamer designed expressly for voyages between Europe and America was the Great Western, built by Patterson of Bristol, and engined by Maudslay of London, under the superintendence of Sir I. K. Brunel. Constructed of wood, she was launched on the 19th of July, 1837. Her dimensions were as follows: length between the perpendiculars, 212 ft.; breadth, 35 ft. 4 in.; and displacement, 2300 tons. She was propelled by paddles. This ship crossed the Atlantic in 1838.

In 1840 the Cunard Company made their first passage across the Atlantic, from Liverpool to Boston, in the Britannia, also of wood and propelled by paddles. This ship and her sisters, the Acadia, Caledonia, and Columbia, were of nearly the same size and proportions as the Great Western. They were of 1200 tons gross register, and the engines were of 440 nominal horse-power. They made their passages at a speed of about 8½ knots an hour.

In 1843 Brunel made a new and most striking advance, producing in that year the ocean-going steamship Great Britain, built of iron, and propelled by the screw. This ship was 286 ft. long.

The first iron ship built for the Cunard Company was not commenced until 1852. Their celebrated iron paddle-steamer Persia was built in 1856.

In 1850 the Inman Line was established, the first ship being the City of Glasgow, an iron screw steamer, built for carrying passengers from the Port of Liverpool.

The White Star Line, which started in 1870, produced in 1874 the two splendid steamers Britannic and Germanic, 455 ft. long, and making an average ocean speed of 15 knots an hour. These ships represent in provision for security of life, by care in construction and good subdivision, a remarkable example of resolution on the part of owners and builders to take no advantage of the abandonment by the Government in 1862 of all legislative control over internal subdivision in mail and passenger ships. They gave as much in this respect as the Government had been vainly asked by the Council of the Institution of Naval Architects in 1867 to impose by statute.

The White Star steamer Baltic had in 1873 reduced the passage to 7 d. 20 h. 9 m. The Britannic still further reduced the time from Queenstown to New York, in 1876, to 7 d. 10 h. 53 m. The last mentioned steamer averaged for the year 1876, 7 d. 18 h. 26 m. outwards, and 7 d. 20 h. 56 m. homewards, while for the last ten years her average has been 8 d. 9 h. 36 m. outwards, and 8 d. 1 h. 48 m. homewards. The quickest run she has accomplished was—surprising to relate—made in February of the present year (1887), when she crossed from New York to Queenstown in 7 d. 9 h. 40 m.—nearly thirteen years after she was built, and with her original boilers on board.

The following remarkable fact in connection with the Britannic and her sister ship the Germanic deserves notice, as it is probably unexampled in the records of ocean steaming.

These two vessels, during the seven years ending 1886, each performed 71 voyages from Queenstown to New York, covering 201,000 miles. The average time of the Britannic was 8 d. 11 h. 57 m., and that of the Germanic 8 d. 11 h. 36 m.!

Between 1874 and 1879 no further great advance was made in Atlantic steaming; but in that year the Arizona was added to the Guion Line, and she proved to be somewhat faster than the Britannic.

Stimulated by this, the Cunard Company produced the Gallia and Servia, and the Inman Company the City of Rome in 1881. In the same year the Guion Line brought out the Alaska; and in 1883 the Oregon was built for that line, but was purchased and worked by the Cunard Company. This latter Company brought out the Aurania in 1883, and the Umbria and Etruria in 1885.

The America had been built during this period for the National Line, and had proved to be a very successful ship. The great depression in trade which followed induced the owners of this ship to sell her in 1886–7 to the Italian Government. She is now named the Eritréo.

Taking the ships in the order of their absolutely fastest passage, out or home, they stand as follows:—

Built.		D.	H.	M.
1881 to 1885	Umbria (out)	6	4	29
	Etruria (out)	6	5	31
	Oregon (out)	6	9	51
	America (home)	6	14	18
	Alaska (home)	6	18	37
	City of Rome (out)	6	21	51
	Aurania (home)	7	0	8
	Servia (home)	7	0	33
1874–5	Britannic (home)	7	9	40

With the frequent improvements which are taking place in Marine engineering, it is not easy to look very far ahead, but it may safely be predicted that the next development in high class merchant steamers will prove a remarkable one, and it would seem that the policy which has been advocated by various practical administrators of the Admiralty, regarding the attitude of that department towards the Mercantile Marine, has at last been brought to fruition with results which cannot but conduce to the national advantage.

New ships for White Star Line.

The White Star Line—as in 1870 and 1874–5—appear to be again about to take the lead in the direction indicated. This company have now on the stocks the first of two steamers for their Atlantic service, answering to the most recent and the highest type of Admiralty requirements for armed cruisers. The dimensions are said to be—length, 565 ft.; breadth, 58 ft.; gross tonnage, about 10,000 tons, with a speed equal to any merchant steamer now crossing the Atlantic,

There will be one or two features in these new White Star ships, which deserve special attention. While all the preceding steamers built by Messrs. Harland and Wolff for this company have been well subdivided by transverse bulkheads, a marked advance will be made in the new vessels by the addition of a longitudinal bulkhead running the entire length of the ship, and extending upwards from the keel to above the water-line, dividing the engine room and stoke-hold into two distinct parts fore and aft. In the event of their being employed as armed cruisers, the great value of this provision is obvious.

The motive power is to consist of two sets of triple expansion engines, the various parts of which will be interchangeable—driving twin screw propellers. The engines and boilers will be arranged in separate compartments below the water-line, and will be furnished with forced draught. Abreast of engines will be the coal bunkers, so arranged as to form a protection from shot in case of hostilities.

Arrangements will be made for steering below the water line, so as to provide against damage to steering gear, or the rudder head being shot away in action.

It is noteworthy that the length of these vessels is identical with that given in designs prepared for the White Star Company in 1880, but circumstances were not then favourable to the building of ships of this type, and the public may now be congratulated upon the fortuitous combination of events which led to the co-operation of the Admiralty and the Post Office in encouraging shipowners to build and maintain vessels which are likely to prove of real service in times of national danger.

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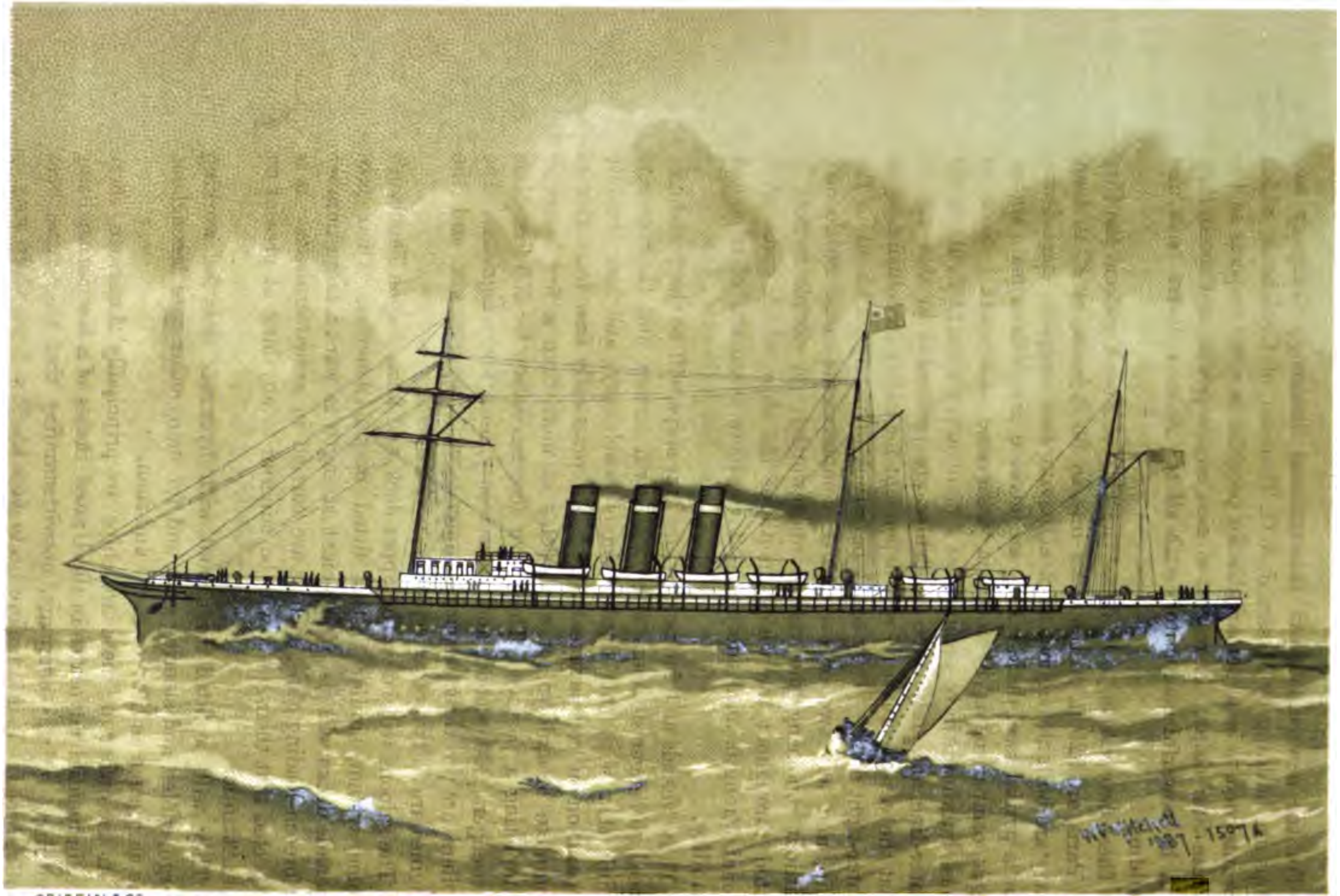

GRIFFIN & CY.
PORTSMOUTH.

INMAN & INTERNATIONAL C^{os}
TWIN SCREW SHIPS "CITY OF NEW YORK" & "CITY OF PARIS"

For the new Inman and International Steamship Company two ships are building by Messrs. J. & G. Thomson, of Clydebank, which are intended to be as remarkable for progress in some respects as the White Star ships. In respect of size, engine-power, and speed, they will be powerful competitors with all the Atlantic liners built and building.

New Inman ships.

These two vessels, to be called the City of New York and the City of Paris, are 525 ft. on the water-line, by 63 ft. beam, by 42 ft. deep. They are built throughout of steel, having four complete steel decks, and a partial steel deck. They are divided into fifteen main water-tight compartments by fourteen transverse bulkheads. None of these bulkheads have openings at a point lower than 11 ft. above the water-line, and only three amidships are perforated in this way, so that the vessels are in no way dependent for safety in collision upon water-tight doors. They could be struck upon any bulkhead in the ship, and any two or even three compartments could be flooded, without rendering the vessels unseaworthy. A double bottom is fitted throughout the whole length of the ship, which gives additional strength and safety and a complete command of trim and stability.

These vessels and the new White Star ships will be the first high-speed passenger steamers fitted with twin screws, and their owners think that with this duplication of machinery, and the absolute separation of compartments, they are practically free from risk of complete breakdown, or even delay of more than a few hours in completing a passage. They have accommodation for 650 first-class passengers, 200 second, and, if necessary, for a few emigrants. The boilers are in three separate water-tight compartments, and the engines are in two other separate compartments.

The saloons will be on the upper deck, and formed upon Thomson's dome system, similar to that fitted in s.s. America. Their promenade decks will be of sufficient strength to work a large number of breech-loading guns, such as are carried in armed cruisers. It is expected that their speed will be superior to anything at present on the Atlantic.

They will be fitted throughout with hydraulic gear for working cargo, cables, and steering gear, and for many other uses throughout the ship, such as lifts for stores and men.

As the owners of these two ships are principally American, there are influential advocates in the United States of a law nationalizing the ships of this company, notwithstanding that they have been built abroad. It is therefore quite possible that these ships may be

M 2

subsidized by the United States Government, and partly manned by the State Navy.

Large mercantile ships.

The number of British steamships of large size (2000 tons net register and upwards) was, according to Lloyd's Universal Register for 1886, 280. Of similar ships belonging to other nations at that date the number was as follows: French, 65; German, 24; American (United States), 21; Spanish, 9; Italian, 8; Dutch, 8; Belgian, 8; Austrian, 5; Russian, 1; Danish, 1; the total number being 150. Of the 280 British ships, 30 were of 3000 tons net register and upwards. Ships of these dimensions possessed by other countries were as follows: France, 9; Italy, 2; Belgium, 2; United States, 1; total number, 14.

British owners of large ships.

The principal British owners of ships of 2000 tons net and upwards are:—

		Ships.
Peninsular and Oriental Co.	London	26
Anchor Line	Glasgow	18
White Star Co.	Liverpool	13
National Co.	"	12
Allan Line	Glasgow	12
Geo. Smith & Sons	"	11
Pacific Steam Nav. Co.	Liverpool	10
British India Steam Nav. Co.	London	10
Cunard Co.	Liverpool	9
Donald Currie & Co.	London	7
Union Steamship Co.	Southampton	7
British Shipowners Co.	Liverpool	6
Orient Steam Nav. Co.	London	6
Eastern Steamship Co.	"	6
Clan Line	Glasgow and Liverpool	5
W. Johnston & Co.	Liverpool	5
Mississippi and Dominion Co.	"	5
New Zealand Shipping Co.	London	5
Royal Exchange Shipping Co.	"	5

Foreign owners of large ships.

The principal foreign owners of ships of 2000 tons net and upwards are:—

		Ships.
Messageries Maritimes	Marseilles	28
Compagnie Générale Transatlantique	Paris	12
Hamburg Amerikan	Hamburg	12
Norddeutscher Lloyds	Bremen	10
Société Anonyme de Navigation Belge-Americaine	Antwerp	8
Compagnie de Transport à Vapeur	Havre	7
" Nationale de Navigation	Marseilles	5
Lloyd Austro-Ungarico	Trieste	5
Stoomvart Maatschappij Nederlandsche	Amsterdam	5

The Peninsular and Oriental Steam Navigation Company.

The Peninsular and Oriental Steam Navigation Company, which began its operations in 1837, and has employed during its fifty years of existence 153 ships, has now a fleet built and building of 53 ships, with a gross registered tonnage of 200,000. These are all propelled by single screws, and are built either of iron or steel.

The first ship built of steel for this company was the Ravenna, constructed by Messrs. Denny of Dumbarton in 1880. They have now eighteen steel ships built and building.

There is only one ship in the fleet as much as twenty-five years old; and she was lengthened, and had new engines given her twelve years ago. Since the formation of the Admiralty List in 1876, the ships of this company have, as a general rule, been built to satisfy the Admiralty conditions as to division into compartments.

In the last four ships there are eight bulkheads extending to the main deck. This deck, at the average draught of 22½ feet, is six feet above water. Of these eight bulkheads, five extend one deck higher than the main deck.

These ships have in all twenty-one water-tight compartments.

Commencing with 7 lbs. pressure of steam per square inch in the boilers of their ships, this company reached 40 lbs. in 1870; 70 lbs. in 1874; 80 lbs. in 1880; 90 lbs. in 1881; 140 lbs. with triple expansion engines in 1885; and 150 lbs. in the latest ships.

In 1880, the highest engine power they had reached was 3,800 horses. In the newest ships it is 7000 horses. This high power is rendered possible, with a reasonable expenditure of fuel, by the fact that a horse power can now be produced, with the propelling machinery employed, with as little as 1·6 lbs. of fuel per I.H.P. per hour.

By the courtesy of Mr. Sutherland, the following details of the new ships have been furnished for the present work:—

Victoria, Oceana, Britannia and Arcadia.

		ft.	in.
Length from the fore-side of stem to the after-side of stern-post		466	0
Breadth, moulded		52	0
Depth from top of keel to top of spar deck beams at the middle		37	0
Builder's Draught of water		25	6
Displacement to this draught		10,860 tons	
Register Tonnage	Gross	6268	
	Net	3168	

The propeller of each ship is four-bladed of 20½ feet diameter.

The steam cylinders are 40 in., 63 in., and 100 in. in diameter; and the length of the stroke of the engines is six feet.

Two of the boilers are 14 ft. 8 in. in diameter and 18½ feet long; and four are 13 ft. 8 in. in diameter and 17 feet long. There is, besides, an auxiliary boiler 12½ feet in diameter, and 10 feet long.

The crane service, capstans, and cargo gear are worked by water power.

The electrical machinery will maintain several search lights in addition to the internal service of 500 incandescent lamps.

The refrigerating room for preserving meat and fruit occupies about 30,000 cubic feet of space in the after hold.

The regular or normal fuel supply for the ships is 876 tons, and there are reserve bunkers admitting of 1,000 tons further supply if required for any special and extended service.

The troop decks will carry about 1,500 men outside the first and second saloon cabins.

Positions have been assigned for twelve guns should the ships be taken up by the Government for armament as war auxiliaries.

Steamship Ormuz, Orient Steam Navigation Co.

The Ormuz was designed and built for the Australian Passenger Service by the Fairfield Shipbuilding and Engineering Company. The principal dimensions and general particulars of the ship are as follows:—

Length over all	481 feet
,, between perpendiculars	465 ,,
Breadth Moulded	52 ,,
Displacement at load line	10,500 tons
Mean load draught of water	26 feet
Gross register tonnage	6,116
Effective horse-power	8,500

The ship, which is stated to have obtained a speed of over 17½ knots on the measured mile, is thus described by the owners:—

"This ship is wholly built of mild steel. She has a double bottom, with a space of over 3 ft. between the inner and outer bottoms, and this is divided by bulkheads or divisions across the ship into many compartments, which are again subdivided fore and aft the ship by the ship's keel. These divisions are perfectly water-tight, so that no water can pass from one side of the ship to the other in the double bottom. Above the double bottom, the bulkheads rise in most cases to the height of the upper deck. These are also water-tight, and the holds have been so divided that even if two of the largest of them were filled with water, the Ormuz has sufficient surplus buoyancy to enable her to keep afloat with safety. She is thus fully qualified for employment as a war cruiser, and her name has accordingly been placed on the Admiralty List, after survey by an Admiralty Officer.

"The engines are on the triple expansion principle. The high-pressure cylinder is 46 in. in diameter, the intermediate cylinder 73 in., and the low-pressure 112 in., all having a stroke of 6 ft.

"The boilers are six in number and constructed entirely of steel, and adapted for a working pressure of 150 lbs. per square inch. Each boiler is about 15 ft. diameter and 18 ft. long, and fired from both ends, having 6 furnaces of corrugated steel. Two additional boilers are fitted for use in connection with the distillation of fresh from sea water, also for working the fire engines and for general purposes. There are also a number of fire engines capable of throwing about 300 tons of water per hour through the fire hose. The total pumping power on board is capable of discharging about 3300 tons of water per hour."

In October last the fastest voyage on record between England and Australia was accomplished by the Ormuz. She left Suez on the 27th of October, and arrived at King George's Sound eighteen days later, November the 14th, and landed the mails and passengers in the unprecedented time of twenty-four days from London. Throughout the voyage from the head of the Red Sea to the extreme south-western corner of the Australian continent, the vessel travelled at an average speed of more than eighteen miles an hour—a rate considerably in advance of anything yet accomplished on the voyage to Australia.

The following descriptions of ships and results obtained have been taken from accounts given in the London engineering papers, *Engineering* and *Engineer*.

Steamship Oroya.

The Oroya is the second vessel of her kind which the Pacific Steam Navigation Company has recently added to its large and magnificent fleet, and is intended to ply between London and South Australian ports in conjunction with the steamers of the Orient Steam Navigation Company. The sister vessel, Orizaba, has completed her first voyage with remarkable success, and is again on her way out to the Antipodes. The Oroya, which started for her first voyage on the 17th of March last, reached Adelaide after a rapid and most successful run.

Both these steamers have been constructed at Barrow by the Barrow Shipbuilding Company.

The Oroya is 460 ft. in length, 49 ft. in breadth, and 35 ft. 6 in. depth of hold, and has a gross register tonnage of 6200 tons. She is fitted for the reception of 126 first-class and 154 second-class passengers in the state-rooms, which extend along nearly the whole range of the main deck, and has also accommodation for over 400 emigrants in the 'tween decks below. She also carries over 1000 tons of cargo.

During the very successful twelve hours' trial in the Irish Sea on January 21st and 22nd of this year, the highest indicated horse-power developed was 6751, with 64·5 revolutions and a steam pressure in the boilers of 160 lb., the vacuum being 26 in. The mean speed of the 12 hours' run was 16·5 knots, the mean displacement being 8840 tons, on a mean draught of 22 ft. 7 in. The mean indicated horse-power for the whole run was about 6500, with 64 revolutions.

The City of Dublin Mail steamer Ireland.

Some twenty-five years have elapsed since the City of Dublin Steam Packet Company had four steamers—the Leinster, Ulster, Munster, and Connaught—constructed to carry mails and passengers between Holyhead and Kingstown. These ships were unique, of unsurpassed dimensions and speed for such a service, and have been in every way successful. They are still plying without abatement of speed, comfort, or sea-going qualities, having been recently fitted with forced draught. The City of Dublin Steam Packet Company determined, however, to add to its fleet, and the Ireland is the result of this determination.

Built by Messrs Laird Brothers, the Ireland has a length over all of 380 ft., or between perpendiculars of 360 ft., with 38 ft. beam, and a depth in hold of 19 ft. 3 in., her tonnage being 2590 tons O. M. She is built entirely of Siemens steel, and is subdivided by steel water-tight bulkheads carried to the upper deck into eleven compartments, so arranged that the engines and each set of boilers are in separate compartments, and in the event of damage to any two compartments the ship would still have sufficient buoyancy.

The engines are oscillating, of the ordinary double piston-rod jet-condensing type, having two diagonal air pumps, worked by an eccentric on the intermediate shaft. The cylinders are 102 in. diameter and 102 in. stroke; the piston-rods are of steel, 10½ in. diameter. The entablatures are of cast iron, and of box form, and are strongly supported by eight wrought-iron columns, each 9¼ in. diameter. The shafts, cranks, and crank pins are of Whitworth's fluid compressed steel, the shafts being 24½ in. diameter in the bearings and hollow throughout, the diameter of hole being equal to one-half the diameter of shaft. Each cylinder has two slide valves, worked by a link motion in the usual way; and a combined steam and hydraulic starting gear enables the engineer to handle these powerful engines with great rapidity.

The paddle-wheels are 33 ft. 4 in. in diameter over the floats, with eleven floats to each wheel, 13 ft. wide, and 5 ft. 9 in. deep.

Steam is supplied by eight rectangular boilers made of steel, four placed before and four abaft the engines, working at a pressure of 30 lb. per square inch.

The boilers contain in all thirty-two furnaces, 3168 tubes, and have a total heating surface of 22,750 square feet, and a grate surface of 807 square feet. The boilers may be worked under natural draught or under air pressure, sufficient ventilation being provided for the former, while the stokeholes can be readily put under air pressure by closing the ventilators and working double fans placed on deck. These double fans are four in number, 8½ ft. diameter, each driven by two separate engines, and capable of maintaining an air pressure equal to 2½ in. of water in the stokeholes.

Jet-condensing engines have been adopted on the score of lightness, in order to get the requisite power on small displacement; and indeed for this service, where the run from port to port is very short and good coal obtainable at a low price, compound engines do not offer any advantage, seeing that the reduced weight of coal to be carried would not go far to compensate for the extra weight of machinery nor would the saving in cost of fuel go far to meet the extra first cost of compound engines.

The speed of the Ireland is 24 statute miles an hour.

Liverpool and Isle of Man passenger steamer Prince of Wales.

With the new paddle-steamer Prince of Wales, the second of the two vessels built for the Liverpool and Isle of Man passenger trade by the Fairfield Shipbuilding and Engineering Company, a still greater success in the way of speed has been scored than that recorded in respect of the Queen Victoria, the sister steamer. When running her official trial trip on Thursday, May 26, she ran at one time at the extraordinary rate of 24¼ knots per hour; but the official return for the distance between Ailsa Craig and Cumbrae Lighthouse was 22·6 knots, or equal to 26 statute miles per hour. This vessel and her sister ship both measure 340 ft. by 39 ft. by 24 ft., and they are registered as vessels of 1500 tons each. They will each carry 1600 passengers, in addition to a crew of 60. There are in each ship eight water-tight bulkheads, seven of which are carried up to the main deck, and the water-tight doors between the engines and boiler spaces are fitted with self-closing arrangements. The engines are of the compound diagonal and direct-acting type, indicating 7000 horse-power, and having cylinders of 61 in. and 112 in. respectively, with piston stroke of 6 ft. 6 in. Steam is supplied by four double-ended boilers, 15 ft. in diameter and 19 ft. 6 in. long, fitted with twenty-four of Fox's corrugated furnaces, and adapted for a working pressure of 110 lb. per square inch. All the furnaces are fitted with forced draught.

The new Channel steamer, Empress.

The Fairfield Shipbuilding and Engineering Company (Limited), Govan, recently launched the Empress, a steel paddle steamer of 1200 tons register, which has been constructed for service in the English Channel. Sister ship to the Victoria, which was launched from the same yard last year, she has a rudder forward and aft, so as to facilitate her movements on entering and leaving the Channel harbours, and she measures 325 ft. by 34 ft. 9 in. by 22 ft. to upper deck. In her hull there are eight water-tight bulkheads. The steamer is being fitted with a set of compound diagonal direct-acting engines, with surface condenser, the cylinders being 58 in. and 104 in. in diameter respectively, and both adapted for a piston stroke of 6 ft. The high-pressure cylinder is placed above the low-pressure cylinder. Steam of 110 lb. pressure will be supplied by four double-ended steel boilers, containing collectively twenty-four of Fox's corrugated furnaces; and arrangements are being made for working the boilers with forced draught.

A combined cruiser and telegraph cable ship.

The idea of building mercantile vessels in such a way that they can be of service as naval cruisers has found expression in an advanced form in the steamship now being built by Messrs. William Doxford and Sons, of Sunderland, for the China Telegraph Service. This vessel is provided with all the usual apparatus for the laying and repair of submarine cables, and in addition she carries six large guns. Of these, four are in the 'tween decks, with specially constructed water-tight ports, and two long range 6-in. Armstrong breechloaders are on the upper deck. For the accommodation of these latter, which are arranged as bow and stern chasers, the windlass and steering gear have been considerably modified, so that they may offer no obstruction to the fire. The guns are mounted on cylinders 5 ft. in diameter, built of steel, on the 'tween decks, and the stern weapon has an all-round fire up to 68 deg. before the beam. The hull is of Siemens-Martin steel, $\frac{3}{4}$ in. thick, and measures 220 ft. by 32 ft. by 20 ft., and the ship is fitted with triple-expansion engines indicating 1100 horse-power, calculated to drive it at 13 knots an hour.

Shipbuilding on the Clyde in 1886.

Steel, as the material of construction in shipbuilding, is attaining more and more prominence every year. It is but a very few years since this material began to assume any prominence at all in the Clyde shipbuilding returns, and yet the returns of the past year show that the total output of steel shipping formed about five-eighths of the whole. During the year the steel-built shipping amounted to 122,213 tons, as compared with 53,091 tons of iron-built shipping, the remaining 668 tons being built of wood. In the year 1881 the steel tonnage built was only 70,000 tons, as compared with 261,500 tons of iron-built shipping. The increase is very much more in the steam tonnage than in the tonnage of sailing vessels. In the year 1881, for example, the proportions were 46,113 tons of iron shipping, and 19,799 tons of steel shipping. The returns for 1886, in respect of screw steamers, show that steel was employed in building 69,002 tons of such shipping, while the output of iron-built screw steamers was only 4855 tons.

The Admiralty List.

In December 1876 the principal British shipowners were informed by the Lords Commissioners of the Admiralty that a register or list of ships complying with a certain condition—an efficient subdivision into water-tight compartments—would be kept at the Admiralty with a view to their utilisation if required in time of war, and the co-operation of the owners was invited.*

Five years afterwards, of the large ships on this list having average ocean speeds of 12 knots and upwards, the distribution among the principal companies was as follows:—

	No. of Ships.	Gross tonnage.
Anchor Line	13	51,146
Cunard Line	10	50,275
White Star Line	9	37,556
Peninsular and Oriental Co.	10	35,182
Pacific Line	8	33,064
Royal Mail	8	26,878
Orient	6	26,574
Donald Currie & Co.	8	25,389

There were, in 1881, twenty companies contributing a total of 100 ships of considerable size, good ocean speed, and fair subdivision, but 72 per cent. belonged as shown to the eight above mentioned.

During the first 4½ years of the existence of this Admiralty List of ships fairly divided into compartments and otherwise suitable for auxiliary war service, the number of ships offered for the list was 902. Of these 207 were admitted. Of those admitted the number lost in 4½ years was one in twenty-seven, while of those not admitted it was one in ten.

Of the ships on the Admiralty List which were lost, all were lost by going ashore, and none by collision. Of those which had not been admitted to the list, for reasons given to the owners, 61 ships were lost in 4½ years, and of these 24 foundered at sea, 14 directly from collision with other ships.

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* The steamers of the White Star Line were at the time among the very few merchant ships in existence which complied with the conditions as to subdivision into compartments in order to give reasonable provision against foundering if injured in the plating under water.

The actual analysis of losses is as follows:—

No. of Ships.	Gross Tonnage.	Causes of Loss.
14	20,090	Collision with other vessels.
10	14,380	Foundered at sea from various causes.
8	15,237	Struck rocks and foundered in deep water.
28	53,012	Went ashore and became total wrecks.
1	2,273	Destroyed by fire.

During this same period 14 of the ships on the Admiralty List had serious collisions, and were saved by their water-tight bulkheads. These ships were:—

	Tons.
Agia Sofia	2586
Anchoria	4168
Arizona	5147
Baltic	3707
British Queen	763
Chimborazo	3847
City of Agra	3193
Helvetia	4588
Kinsembo	1868
Merlin	643
Phœnician	2386
Sumatra	2408
Sutherland	959
Utopia	2731

In 1885 the number of ships having average ocean speeds of 12 knots and upwards to 18½ knots, and complying with the conditions of the Admiralty List, had increased to 155. To this number there were nine principal contributors, making 70 per cent. of the whole. They stood as follows:—

	No. of Ships.	Gross Tonnage.
Peninsular and Oriental Co.	28	111,130
Anchor Line	17	71,004
Cunard Line	12	69,383
White Star Line	13	55,737
Donald Currie & Co.	11	38,933
Pacific Mail Line	8	33,064
Royal Mail Line	9	29,319
Orient Line	6	26,302
British India Line	6	24,107
		459,239

The remarkable increase in the ships of the Peninsular and Oriental Company, placed upon the list between 1881 and 1885, marks a national gain which can only be properly appreciated by experts. It reflects the highest credit upon the management of that great Company.

At this date the 155 ships of average ocean speeds of 12 knots and upwards, of which the foregoing formed the principal constituents, had a gross register tonnage of 635,000. This would correspond with about 900,000 tons displacement.

There were at the same date on the list 57 other ships of 158,500 gross register tons, capable of steaming at 12 knots for, say, 6 to 12 hours; and 198 ships of 410,000 tons of lower speeds.

But looking only at the superior class of 12 knots to 18½ knots average ocean speeds, the tonnage of such ships on the Admiralty List in 1885 was 25 per cent. greater than the entire French State Navy armoured and unarmoured, built and building; or, to compare it only with their unarmoured navy, the displacement of this superior section of 155 ships on the list in 1885 was three times as great as that of the French unarmoured war navy, built and building at that date.

In the fact that these merchant ships had, with only three exceptions, single propellers and unprotected steering apparatus, the French ships of war had not much advantage over them. The war ships had, however, the great advantage of submerged propelling machinery, while in the merchant steamers the propelling engines always extended above the water line. It is not pretended that the actual fighting ability of this powerful section of the British mercantile marine against a war navy is under present circumstances considerable. But its powers must, nevertheless, be in the highest degree important for auxiliary service in war, and the development of its capacities is worthy of the deepest national solicitude.

Merchant ships taken for War purposes in 1885.

In the spring of 1885, in prospect of war, 16 ships of this superior class as to speed on the Admiralty List were taken up in different parts of the world as armed cruisers. They had a total gross tonnage of 78,397, and varied in average ocean speed from 12 to 18½ knots. Ten of these ships had average ocean speeds of 14 knots and upwards, and six had 16 knots and upwards. At the same time 118 transports were engaged. Of these 25 were on the Admiralty List.

In the statement of the First Lord of the Admiralty, presented to Parliament with the Navy Estimates for 1887–8, reference is made to the utilisation of auxiliary resources as follows:—

"The inquiries, which an Intelligence Department must needs

Statement of First Lord of the Admiralty. 1887.

make, brought before the Board in forcible contrast the great disproportion between the volume of floating commerce of the Empire to be protected and the force at present available to protect it, compared with the mercantile and war marine of foreign nations. To bring the British Navy and commerce into the same relative proportion as that which exists elsewhere in Europe is neither needed nor practicable. To carry out a plan which, at the approach of war, would immediately convert our fastest and most powerful merchant-vessels into effective war-cruisers, and thus turn the assailed into assailants, seemed a natural solution of the difficulty; but there were various obstacles to its realization. The cost of retainers, the difficulty of providing crews and stokers, the delay in the alterations necessary, the contingency that when wanted the vessel might be at the other end of the world—these difficulties in combination deterred previous Boards from making the experiment.

The enormous sums spent in taking up vessels in 1885, many of which never left harbour, and the long delay in getting the guns and fittings into the Oregon, the only vessel thoroughly equipped of all those hired, impressed upon my colleagues and myself the duty of taking some action in the matter. Exceptional speed and strength are the only desiderata of a mercantile cruiser. It occurred to us that the Post Office expenditure might be utilized, and that if we worked in combination, postal contracts could be associated with conditions by which the use of the vessels carrying the mails might under certain contingencies be economically secured to the State. The revision of the North American contract was a most favourable opportunity for a trial of the idea. The White Star Company, one of the tenderers, had, in August last, expressed their willingness to build two vessels to be approved by the Admiralty, of a speed and strength superior to any merchant-ship afloat, with engines and boilers below water, with fittings for guns built in during construction, and, when manned, with half crews of Naval Reserve men.

In return for their use, the company requested an annual subsidy which would recoup the owners a portion of the larger outlay the exceptional construction of the vessels required.

The Cunard Company, another of the tenderers, has the fastest English ships afloat. A large portion of the officers and men in the employ of the Cunard Company are Naval Reserve men. Their ships are never more than eight days distant from Liverpool, and therefore, always obtainable at short notice.

The Admiralty, after full consultation with the Treasury and Post Office, commenced negotiations with these two companies.

They were influenced greatly by this consideration, that merchant vessels, when armed, to be really serviceable, should have exceptional speed and coal capacity, enabling them to overhaul the weak and to escape from the strong.

Such exceptional speed entails a primary cost in engines and boilers, and a consumption in coal that renders the remunerative employment of the vessel very difficult. Only a few of the richest and best-conducted passenger lines can afford to build such vessels, and the profits derived from their employment in recent years have been small.

Unless some inducement is given by the English Government to continue the building of such vessels, they must diminish in number, whereas abroad, by subsidies, their construction is directly encouraged. It is neither to the credit of the country, nor for the advantage of our Marine, that vessels of this class should mostly be under foreign flags.

The arrangement made with the two companies differs in detail, but is the same in principle.

By the payment of an annual subsidy, reduced one-fourth so long as the mail contract lasts, the Government obtain from the Cunard Company the use of the Aurania, Etruria, and Umbria, in time of emergency at a price fixed both as regards hire or sale. The necessary platforms and fittings for carrying guns are to be put in at once; the crews of the ships to be half Naval Reserve men; the owner to take charge of the gun mountings required. Under this arrangement, it is believed that within a week all three vessels could be fitted, armed, stored, and manned as armed cruisers. The use, at fixed prices, of the remainder of the fleet, if required, was a secondary condition of the contract.

With the White Star the arrangement was practically the same, except that no payment was to be made till the two new ships to be built were ready for sea.

By this arrangement the Admiralty have obtained, at a moderate annual cost, the use for five years of the three fastest steamers afloat, and two even faster, when constructed.

Negotiations with the Australian Colonies have for some time past been carried on, which, though not concluded, will, we hope, result in those countries contributing towards an extension of the Imperial Navy, and maintaining, as an integral part of the fleet, an Australian squadron, in addition to the force which has hitherto been stationed in those waters."

In further explanation of the First Lord's Memorandum it may be stated that the White Star line undertakes to hold at the disposition of the Admiralty for purchase or hire at option, at any time during the continuance of this agreement, the following vessels, without charge, viz. :—

Names of Ships.	Tons.	Value.
Britannic	5,004	£130,000
Germanic	5,008	130,000
Adriatic	3,888	100,000
Celtic	3,867	100,000

In the event of purchase the foregoing prices are to be held as the values of the vessels on January 1, 1887, plus 10 per cent. for compulsory sale, less an abatement of 6 per cent. per annum on the depreciated annual value for the period that may elapse between the 1st of January, 1887, and the date of purchase by the Government. In such case the company shall be entitled to remove from the ship or ships the plated-ware, cutlery, crystal, earthenware, blankets, counterpanes, and linens, which articles are not to be considered as part of the equipment of the ships. Such quantities, however, as may be necessary for the officers and warrant officers that would form part of the ship's complement, if used as an armed cruiser, are to be left on board free of charge.

The rate of hire of the before-named vessels, of any or all, is fixed at the rate of 20 shillings per gross registered ton per month if the owner provides the crew, or at the rate of 15 shillings per gross registered ton if the Admiralty provide the crew. All risks of capture and of hostilities are assumed by the Admiralty. The company is to be allowed seven days' pay at the stipulated rate of hire, for any of the vessels chartered, for taking down cabin fittings not required by the Admiralty, and ten days on the same pay at the termination of the service for replacing those fittings, the work of dismounting, dismantling, and reinstating to be performed by the company at the expense of the Admiralty.

Should the Government hire, and subsequently elect to purchase any steamer under this agreement, three-eighths of the amount of hire paid during the period, not exceeding six months immediately preceding the purchase, will be allowed by way of rebate from the amount of purchase-money provided by these presents.

During the currency of this contract any vessels which may be substituted in the mail service for those before-named, except the steamers hereinafter referred to, shall also be subject to the like conditions as regards purchase and hire. In the event of purchase the price shall be fixed at the cost price to the company, with 10 per cent. additional for compulsory sale, less an abatement in the manner previously provided.

The company agree to construct two vessels of such type and speed as shall render them specially suitable for service as armed cruisers, and in accordance with the plans and specifications approved by the Admiralty. In consideration the Admiralty agree to pay to the company for these vessels so approved an annual subvention, payable half-yearly, at the rate of 15 shillings per gross registered ton per annum, such subvention to commence from the date on which these vessels, respectively, start on their first voyage with the mails, and to be continued yearly for a minimum period of five years, terminable at the end of five years or thereafter on twelve months' previous notice, always provided that no subvention is payable to any vessel after January 1, 1894, if the Admiralty shall have given the twelve months' previous notice.

The Director of Naval Construction reports that the plans of these two proposed new vessels provide vessels far in advance of anything that has yet been submitted to the Admiralty for the purpose of armed cruisers. They are to be of large size, of exceedingly high speed, provided with twin screws, have their engines and boilers placed below the water-line, be divided into numerous compartments, and have protected steering gear. They will be capable of conveying fully 2000 men, whom they could land at Bombay *viâ* the Suez Canal in fourteen days, or *viâ* the Cape in twenty-two and one-half days. Their coal capacity will enable them to keep the sea for probably not less than three months.

In the event of the company ceasing to carry the mails under the contract before the company shall have received five annual subventions, they shall be entitled to receive for any part of the period that may not have expired at the time of the termination of the mail contract a subvention of 20 shillings per registered ton per annum, in lieu of 15 shillings. In consideration of the subvention the company is precluded from entertaining, in connection with any of the vessels referred to in this contract, offers for sale or charter for a period exceeding five weeks, unless in case of a longer charter with the approval of the Admiralty previously obtained, without first giving to the Admiralty the option of exercising the pre-emption to purchase or hire, such option to be exercised as regards any vessel receiving a subvention within seven days, and as regards the other vessels within forty-eight hours.

Should the Admiralty elect to charter any vessel receiving the subvention, the rate of hire for such vessel to be at the rate of 20 shillings per gross registered ton per month, the Admiralty providing the crew, or 22½ shillings per ton, if the owners are required to find the crew. In the former case the Admiralty are to assume all risks, in the latter the risk of loss or damage from hostilities only to be for their account. The terms defined for time allowance, for dismantling and refitting, to apply also to those vessels.

In order that the vessels receiving special subvention may be ready for service as armed cruisers at the shortest possible notice, the company shall afford the Admiralty every facility, compatible with the use of the vessels as mercantile ships, for placing on board during the construction of the steamers such permanent fittings and arrangements for their armament on approved plans as will enable them to be prepared for service within a week of arrival and discharge of cargo at Liverpool; and as regards the guns contemplated to be placed upon the upper deck, the Admiralty are to provide the racers and other fittings and gun mountings, which the company are to keep, if required, in their store-house at Liverpool without charge, ready for immediate placing in the ships at the cost of the Admiralty, and to maintain the same in clean order for immediate use free of charge.

One-half of the crews employed for these vessels shall consist, as nearly as possible, of men belonging to the Royal Naval Reserve.

Should any of the ships be sold to a British shipowner approved by the Admiralty, the privileges of this agreement remain attached to the ships under the new ownership.

The price for the ships receiving the subvention is to be the cost price thereof, subject to the conditions for compulsory sale and abatement previously mentioned, but the Admiralty agree not to exercise their pre-emption, as regards purchase only, for two years after their completion.

These two vessels will be completed in about eighteen months (by August, 1888), and the subvention will be an annual charge of £6500 for each vessel so long as they carry the mails, or £8500 should the mails be withdrawn from them.

The price for purchase of the existing fleet of the White Star line is fixed, less an allowance for depreciation, and fixed rates are given for their hire. Although these vessels have not the high speed the

Admiralty seek to obtain, yet they are undoubtedly fast ocean steamers, and will prove efficient transports. The prices named are fair, and afford a protection to the public service against having to pay excessive rates that might be current in time of war.

The Cunard Company agree to hold at the disposition of the Government for purchase or hire during the continuance of the agreement the following vessels, viz:—

Names of Ships.	Gross tons.	Value.
Etruria	7,718	£310,000
Umbria	7,718	301,000
Aurania	7,269	240,000
Servia	7,392	193,000
Gallia	4,809	102,000

On the following conditions:—

A subvention of 15 shillings per gross registered ton per annum to be paid by the Government to the company on account of the Etruria, Umbria, and Aurania during the continuance of the postal contract; but in the event of the termination of that contract before these three vessels have received five years' payment of such annual subvention, the company shall be entitled to receive for the balance of such unexpired period a subvention of 20 shillings per gross registered ton per annum, the five vessels being still held at the disposition of the Government in the same manner as if the postal contract was current.

The subvention to be paid half yearly, on the 1st of April and 1st of October, the first payment (for one month) being due on April 1, 1887.

In consideration of this subvention the company engage to hold at the disposition of the Admiralty in Liverpool, all or any of the above-named vessels for hire or purchase, on terms herein set forth immediately, on the completion of the voyage (but after discharge of cargo) on which the vessel may be engaged at the time of the receipt of the notice of the Admiralty's intention to purchase or hire. The vessels under agreement may be annually inspected by the Admiralty.

The company are precluded from entertaining, in connection with any of the five vessels named, offers for sale or charter for a period exceeding five weeks (unless in case of a longer charter, with the approval of the Admiralty previously obtained), without giving the Admiralty the option of exercising the pre-emption to purchase or hire—such option to be exercised as regards the Etruria, Umbria, and Aurania, all or any, within seven days; and as regards the Servia and Gallia, either or both, within forty-eight hours.

In the event of purchase, the foregoing prices are to be held as the values of the vessels on January 1, 1887, plus 10 per cent. for compulsory sale, less an abatement of 6 per cent. per annum on the depreciated annual value for the period that may elapse between the 1st of January, 1887, and the date of purchase. The company is allowed to remove articles not considered as part of the equipment, as stipulated in the contract with the White Star Company.

In the event of charter by the Admiralty the rate of hire for the Etruria, Umbria, and Aurania, all or any, is to be 20 shillings per gross registered ton per month, without crew; and the rate of hire for the Servia and Gallia, either or both, is to be 15 shillings per gross registered ton per month, without crew. The time allowance for dismantling and reinstating cabin fittings is the same and under the same conditions prescribed in the contract with the White Star Company.

In order to have the Umbria, Etruria, and Aurania ready for service as armed cruisers at the shortest possible notice, the company shall afford the Admiralty every facility compatible with their present use as mercantile ships for placing on board such fittings and arrangement for their armament as will enable them to be prepared within a week of their arrival at Liverpool and discharge of cargo. For this purpose the company consent to the Admiralty fitting the permanent supports and platforms for the four guns to be carried on the poop and forecastle.

As regards these four guns and the eight guns contemplated to be placed on the upper deck, the Admiralty are to provide the racers and other fastenings and gun mountings, which the company are to keep stored, if required, without charge, ready for immediate placing in the ships at the cost of the Admiralty, and to maintain the same in clean order ready for immediate use free of charge.

One-half of the men employed as the crews of these vessels are to be Royal Naval Reserve men.

Conditions of transfer to a British owner approved by Admiralty are the same as in contract with the White Star Company.

If the company determine to build new ships for the mail service they will submit the plans to the Admiralty, that they may be constructed to be suitable for armed cruisers; and if the plans be approved such vessels are to be taken on similar terms to those specified for the Umbria, Etruria, and Aurania.

This contract commenced on March 1, 1887, and is to continue for a period of five years, terminable then or thereafter by twelve months' previous notice.

The annual expenditure for the retention of these vessels will amount to an average of £5400 each.

Utilisation of auxiliary resources by Foreign Powers.

Foreign Powers, as a rule, subsidize steamship companies for carrying the mails so as to encourage the building of ships of high speed, suitable for service in war.

The action of foreign Powers in this respect is described by the Bureau of Navigation at Washington as follows:—

France.

"In the contract of the French Government with the Messageries Maritimes Steamship Company it is stipulated that, in case of war, the Government will have the right to take possession of the steamers and will pay 5 per cent. interest on the capital and reimburse the company the appraised losses or damages.

"The French law of January 29, 1881, offers a navigation bounty to French ships, and increases that bounty by 15 per cent. for ships built in France in accordance with plans and specifications approved by the ministry of marine. These steamers must have such water-tight subdivisions, that if any one compartment be flooded, the others will keep the ship afloat; the boilers and engines must satisfy prescribed tests; the speed is to be at least 13½ knots; coal endurance sufficient to steam 6000 miles, at 10 knots; storage of coal to protect boilers and engines, especially all such parts of the engines as are above the water-line, and the propeller must be under water. These ships must be arranged to carry a number of 14-centimetre 5·5-inch) guns, to be designated by the minister of marine in accordance with the plans of the ship. Gun ports, platforms, and other permanent fittings are to be placed in the ship during construction. The guns, carriages, pivot-bolts, and fittings will be furnished by the ministry and will be stored in a Government storehouse on shore.

"Special suitable arrangements must be provided to receive and store the necessary ammunition on board with safety when required.

"The law of 1881 gives bounties for all ships built in France, but only those which are engaged to carry the mails are required to have special fittings to make them useful as cruisers in war. Later postal contracts require the mail steamers to have these fittings, and a premium for speed is also granted to vessels in the postal service.

"The French ministry also provide for the employment of the *personnel* of the mercantile service in the Navy, and it is contemplated to provide suitable training for this *personnel*. This is not yet definitely settled.

Italy. "Italy supports Italian steamship companies by an annual subsidy of £327,278. The carriage of the mails is obligatory. Civil and military *employés* are to be given transportation at half price.

"An Italian law of 1886 gives a special premium of 24*s*. per ton for every iron or steel ship built in Italy, and 8*s*. for every horse-power of engines and boilers built in Italy and fitted in an Italian ship. These premiums will be increased by from 10 to 20 per cent. for such vessels as may be suitable for use as cruisers in time of war. This special premium will also be given to other vessels purchased by Italian shipowners if suitable for use as cruisers.

"These special premiums and other concessions to the merchant marine of Italy cost the State about £169,000 per annum.

Spain. "The Spanish Government has approved a contract with the Spanish Transatlantic Steamship Company. The Government is to pay 7*s*. 7*d*. per mile run on an American line, and lesser amounts for services to the Philippines, Buenos Ayres, and Fernando Po; payments to be made monthly by the minister of foreign relations. The steamers on the American line are to be of 4500 tons. The company's vessels are to carry the mails and perform whatever extra services may be required for war purposes. All the vessels are to be of iron or steel and strong enough to carry heavy batteries.

Russia. "In Russia the Volunteer or Patriotic Merchant Fleet has been definitely established in order that the merchant service may be auxiliary to the Navy in time of war. New regulations were made in 1885 by which this company received special subvention and were given the mail contract for six years between Odessa and ports of the North Pacific Ocean. This company is directed by a special committee in special communication with the ministry of marine, and has its principal office in St. Petersburg.

"In 1885 these vessels were armed as cruisers as follows:—

"In the Baltic: The Rossja-Moskiver and Petersburg, each armed with one 8-inch rifled mortar, six 6-inch Abouchoff breechloaders, and two Hotchkiss. In the Black Sea: Vladimir, two 6-inch Abouchoff, three 4-pounders, and two Hotchkiss; Rossja II., six 8-inch Abouchoff, three 6-inch Abouchoff, one 6-inch rifled mortar, four 9-pounders, and 6 Hotchkiss; Constantine, one 6-inch Abouchoff, six 4-pounders, and two Hotchkiss; Vesta, five 6-inch rifled mortars, three 9-pounders, and four Hotchkiss.

"The three following vessels of the fleet were not armed, viz.:

Czar, Czarevna, Czarevich. Each of these was to have armaments in case of war consisting of one 8-inch Abouchoff, six 6-inch Abouchoff, four 9-pounders, and six Hotchkiss.

"The Russian Government pays this company an annual subsidy of 599,250 rubles = £81,100, on condition that the vessels perform voyages amounting to 141,000 miles annually.

Germany.

"Germany has subsidized four lines of steamers for a period of ten years, and pays £13,369 for a portion of the service, and for the other portion a sum according to the postal service rendered.

"Germany specially provides for the utilization of the *personnel* in the naval reserve and see-wehr. Officers and men are enrolled and specially trained for transfer to the navy from the merchant marine in case of war."

An agreement somewhat similar to those negotiated with the Atlantic companies was subsequently entered into by the Admiralty with the P. and O. Company.

Debate in House of Commons.

In the House of Commons in Committee, on the vote of £1,911,000 for machinery and ships built by contract, Captain Colomb discussed at some length the subvention granted for the right of pre-emption or hire of mercantile vessels as armed cruisers or transports, which he condemned as unworkable and extravagant. Mr. Forwood defended what he admitted to be a new departure in naval policy, pointing out that for £50,000 a year we should secure the services of the ten fastest steamers afloat, which would act as "scouts," and watch the lines of ocean traffic; while to build and maintain ten armoured cruisers of the same speed and coal capacity would cost us £285,000 a year. Sir E. Reed approved this policy, and the vote was agreed to.

While approving generally the arrangement made with the White Star and Cunard Companies, the conditions agreed upon for the construction of ships are more especially valuable. Where ships are designed with the view to conversion into cruisers, many important features can be modified at comparatively small expense. The arrangement of the bunkers with the view to the effectual protection of the machinery by coal, and an under-water rudder-head and steering apparatus, can be specially provided for without seriously interfering with the efficiency of the ship as a merchant vessel. The additional expense would be only a small percentage of the total cost, and for a sum which the Admiralty have agreed to pay to the White Star Line, owners would be induced to build quite as many ships fulfilling the Admiralty conditions as it would be desirable to subsidize.

The Admiralty would probably hesitate to go beyond thirty ships at present. They will be influenced in this as in other branches of expenditure by the course pursued by other administrations.

Armaments.

It is understood that the armaments for the mercantile auxiliaries have not been neglected. The present Board are reported in the *Broad Arrow* to have issued orders that armaments for thirty merchant ships are to be maintained in readiness at the dockyards, weapons for fourteen being stored at Portsmouth, for nine at Devonport, and for seven at Chatham. Ten ships will carry 12, ten 10 guns, and ten 8 guns. One hundred and twelve 5-inch breech-loaders, sixty-four 7-inch muzzle-loaders, forty-eight 64-pounders, and seventy-six 40-pounders, will also be provided.

Postal Contracts.

While the Admiralty are doing their part, the Post Office authorities should lose no opportunity, through their subsidies for the conveyance of the mails, of securing the services of efficient mercantile auxiliaries. Every ship in receipt of a subsidy for ocean-going mail service should fulfil the conditions laid down by the Admiralty for the building of the two vessels now in hand for the White Star Company. No ship should be allowed to receive a subsidy with a less speed than 18 knots on the measured mile. We are giving the P. and O. Company £265,000 a year, for ten years, accepting a speed of 12½ knots an hour, a further payment of £85,000 a year being made by Victoria, and making no stipulation with reference to the employment of the fleet of the Company for State purposes. Another Company—the Royal Mail—which is in receipt of a subsidy of £90,000 a year for the conveyance of mails from England to the West Indies, should certainly be required, on the renewal of its contract, to provide vessels, or to adapt its present vessels, to the service of the State. As an instance of a lost opportunity, I may refer to the recent launch of the steamer Victoria for the P. and O. Company. The extreme speed of this fine ship, 465 ft. in length, falls much below the standard that ought to be insisted on. With a view to its service as an auxiliary to the fleet, the engines should have been more powerful. If the Post Office and the Admiralty had worked together in this important matter, these conditions would have been secured, and probably without additional expense to the State. The Canadian Pacific Railway have made proposals for the establishment of a service to be performed by five fast ocean steamers, running from Vancouver to Brisbane, at 15 knots. The Canadian Government have called for tenders for a new Atlantic service at 16, 17, and 18 knots. It should be insisted that the vessels to be employed should be fitted for service as cruisers. In insisting on this point my objection is not to the payment of the subsidy, but to the omission to provide stricter conditions with reference to the design and construction of the ships. Vessels of the exceptional speed which alone can be useful as mercantile auxiliaries, are not particularly remunerative to the owners. In 1886 the Cunard Company paid no dividend, the Inman Line collapsed, the Peninsular and Oriental only yielded five per cent. to its shareholders.

A Secretary of State for combined Naval and Mercantile Marine.

Sir Nathaniel Barnaby, an early and a strenuous advocate of the creation of a reserve for the Navy in the Mercantile Marine, has proposed, in furtherance of the same policy, in a paper read at the last meeting of the Institute of Naval Architects, to transfer the supervision of shipping to a Secretary of State, in whom should be concentrated the authority of the present First Lord of the Admiralty and the President of the Board of Trade. If such a combination of duties were approved, the supervision of the Secretary of State would be of a most general character. With the assistance of able Parliamentary colleagues, and competent professional advice, such a department could, perhaps, be worked, and it would certainly tend to bring the Navy and the Mercantile Marine together, thus increasing the resources of the country while preventing duplication of expense. The subject merits consideration. Sir Nathaniel Barnaby must keep his proposal before the public.

CHAPTER XIV.

PROPULSION BY STEAM.

THE progress recently made in steam propulsion is remarkable in all its sections:—

1. In the fuel for generating steam.
2. In the boiler or apparatus for transferring heat from the fuel to the steam.
3. In the engine or apparatus for converting the heat of the steam into work on the propeller.
4. In the propeller.

It is proposed in this chapter to briefly notice the latest developments in these directions.

1. FUEL.

Fuel.

Petroleum refuse, which is left after distilling paraffin from the crude oil, has a heating value about one-third greater than that of the same weight of coal, and where it can be obtained cheaply, as in the neighbourhood of the oil-wells, it is largely used in place of coal, both for locomotives and for marine boilers.

The oil is injected in the form of spray near the foot of the fire-box by a steam jet, so arranged that air is drawn in with the petroleum.

Where fresh water can be obtained for feeding the boiler, the use of petroleum in place of coal promises to increase rapidly; but where the boilers are fed by salt water, the loss of steam and consequent deposition of salt in the boiler may present a serious difficulty.

Mr. Urquhart, writing on the use of this fuel on the Grazi-Tsarïtsùr Railway, South Russia, says in *Engineering,* June 25, 1886:—

"There are now 143 locomotives running on petroleum on this line, in fact no other fuel is used for locomotive purposes, while 25 stationary boilers are fitted with the same arrangement, and give excellent results."

The comparative cost of coal and petroleum per mile in winter is as follows:—

	d.
Bituminous coal	14·
Anthracite coal	11·9
Petroleum refuse	5·5

The corresponding weights of fuel were—

	lb.
Bituminous coal	96·5
Anthracite coal	81·9
Petroleum refuse	48·8

Nineteen trials were made in June to determine the summer consumption, and it was found that, including lighting up, there was used per train mile on the average—

	lb.	cost.
Petroleum	32·08	3·61*d*.

The water evaporated per pound of fuel was 11·35 lb.

Further comparative trials gave weights used per train mile in summer:—

	lb.
Bituminous coal	72·5
Anthracite coal	65·9
Petroleum refuse	31·65

Mr. Parker, Lloyds' surveyor, considers that as soon as the transport from Baku to Batoum of the oil used for fuel has been satisfactorily settled, either by the laying of a pipe line or by greatly increased facilities of carriage on the Trans-Caucasian Railway, this fuel will come into general use for the purely local steamers, and possibly also for coasting steamers trading exclusively in the Mediterranean. He does not think its use can be further extended until oil depots have been established in every part of the maritime world.

2. BOILERS.

Boilers.

In most forms of marine boilers the heating surface is increased by carrying the heated gas from the furnace through tubes to the funnel, such tubes lying in and being surrounded by the water to be heated.

Such an arrangement has been known for many years as the tubular or multitubular system, but the arrangement, notwithstanding its prevalence, is defective.

Writing twenty-five years ago, a distinguished marine engineer said: "This construction enables a very large quantity of heating surface to be crowded into comparatively small space, while the form of the tubes, which vary from 2½ in. to 4 in. in diameter, affords great strength, at the same time that the thinness of the metal composing them offers little impediment to the conduction of heat. They are attended with this inconvenience, however, that the flame arising from the combustion of the inflammable gases in the furnace is prematurely extinguished by the minute subdivision and rapid reduction of temperature to which it is exposed in passing through these small tubes."

Mr. Sennett on boilers.

Speaking of most recent practice, Mr. Sennett says ('The Marine Steam Engine:' Longmans and Co.): "In an ordinary boiler the crowns of the furnaces form the most efficient heating surface, next come the sides of the furnaces above the fire bars, then the tops of the combustion chambers, then the sides and ends, and last of all the tubes."

"By the use in boilers of long small tubes, through which the heated gases have to pass, a large amount of heating surface can be obtained in a small space, and this arrangement is necessary in the present type of marine boilers, though heating surface in this form is comparatively inefficient."

"Only the upper halves of the tubes can be considered as effective heating surface, owing to the difficulty with which the steam can detach itself from the lower halves, and also in consequence of the soot, &c., deposited inside the tubes."

"The direction of the tubes is necessarily the same as that of the currents of hot gases on their way to the funnel, instead of being normal to it, as it should be, in order to extract the maximum amount of heat from the gases."

"Flame cannot pass through long tubes of small diameter, and consequently the useful combustion of the gases cannot extend much beyond the combustion chamber. The flame is extinguished within a few inches from the entrances of the tubes, and the gases pass through unconsumed, possibly, in some cases where strong chimney blast is used, to burst into flame in the uptake or funnel. Instances have occurred in which the funnel has become red hot, and the safety of the ship imperilled from this cause."

"Supposing the gas entering the tubes to be of uniform temperature, the manner in which the heat is transmitted to the water is somewhat as follows:—The particles impinging on the upper surfaces of the tubes give up some of their heat, and thus becoming heavier descend, the motion of the current carrying them forward in their descent, so that their places are taken by the hot particles below and behind them, which act in a similar manner. In all probability, owing to the great velocity of the gases through the tubes, a large proportion of the hot gases in the centre and lower parts of the tubes never reach the surface at all, so that their heating effect is entirely lost."

In one variety of the high-pressure marine boiler, called the double-ended boiler, there are furnaces at both ends, each pair leading to a combustion chamber in the centre. This may be either common to both or may be in two sections separated by a water space.

The boilers are sometimes circular in section with two furnaces, and sometimes, where the height available in the ship admits of it, there is a semicircular top and bottom, and straight vertical sides, and in this case there are three furnaces.

These high boilers are neither economical nor good steam generators as compared with the former types of low-pressure boilers, and such boilers constructed for a steam pressure of 60 lbs. per sq. inch give, according to Mr. Sennett, as an average performance:

Coal burnt per hour per sq. foot of grate . .	21 lbs.
Indicated horse-power developed per sq. foot ordinary draught	8·5
Quantity of water evaporated per pound of coal.	8·1 lbs.

The circular or low boiler has done better, and has burnt 27 lbs. of coal per hour per sq. foot of grate. This boiler has averaged 11 indicated horse-power per sq. foot of grate with natural draught.

These figures are all modified by the use of forced draught by means of fans, the stokehole being closed in and worked with a compression of air represented by a height of 1½ to 4 inches of water in the pressure-gauges. Marine boilers of the types described, which give from 10 to 11 indicated horse-power per sq. foot of fire grate, can be made to give by forced draught from 17 to 18 horse-power; but the locomotive type of boiler, which may be described as a nearly rectangular fire-box enclosed above and on the sides by water, and a cylindrical barrel, of considerable length, filled with tubes through which the flame and gases pass, with 120 to 160 lbs. pressure per sq. inch, as used in torpedo boats, can be made to give over 28 horse-power per sq. foot of fire grate. The coal burned per sq. foot of fire grate per hour can in this type of boiler be raised to 130 lbs. and upwards.

In Messrs. Thornycroft's practice a power of 455 horses has been developed with machinery, boilers, and water in boilers, weighing 11¾ tons, or one I.H.P. for every 58 lbs. of weight.

By the use of the new water-tube boilers, described further on, the engines of the Ariete, which develop about 770 I.H.P. each, have been got within the same weight per I.H.P.

Before the introduction of forced draught the engines in the mercantile marine used to weigh, with the boilers and water in them, 480 lbs. per I.H.P.; in the Royal Navy they were somewhat less.

Forced draught is now being used in ships for commerce, so as to reduce the size of boilers; prevent waste of heat from the funnel; facilitate the employment of small coal, and to keep the internal surface of the boiler freer from soot.

Mr. F. C. Marshall's Paper.

Mr. F. C. Marshall, in a Paper on the progress and development of the marine engine, read before the Institution of Naval Architects, July 26, 1887, gives interesting details on economy of fuel.

"Other applications of forced draught have been adopted primarily with the idea of obtaining economy of fuel, and aim at effecting a more perfect combustion of the fuel, giving higher temperature in the furnace, and, by means of an adequate proportion of absorbing surface, less waste of heat in the chimney, than is necessary to produce the natural draught. Several systems of forced draught with economy of fuel in view have been tried; that which has been the most extensively adopted is the Ferrando system, which, while equally applicable to all qualities of coal, aims chiefly at efficiently burning the small deteriorated Welsh or inferior classes of coals, and accomplishes its purposes admirably. When it is remembered that the individual particles of small or duff coal have the same composition as those of round or screened coal, it will be evident that if the duff coal can be as perfectly burned as the screened coal, it will produce, weight for weight, the same amount of heat and the same evaporative effect.

"The economy to be obtained by using only the same quantity of low-priced small coal instead of good screened coal is of course very marked, but in addition to this, experience has shown that the more perfect combustion with this system gives an absolute saving of coal, when compared, weight for weight, with that of large coal used with natural draught.

"All the sixty-two steamers of the Florio-Rubattino Italian line are fitted with this system, and have been working with it for a considerable period.

"In the Ferrando system the firebars are placed transversely in the furnace; they are very narrow, being only $\frac{7}{16}$ in. thick, and have air spaces between them of $\frac{1}{16}$ in. width. The ash-pits are closed, and the air of combustion is supplied at a pressure equivalent to a head of $\frac{3}{4}$ in. of water."

The universal adoption of some system of artificial draught in war vessels is, in Mr. Marshall's opinion, the prelude to its general adoption in the mercantile marine, where its advantages would be vastly more important and valuable. Some of these advantages he ventures to submit to the consideration of shipowners as follows:—

"1. Reduced size and weight of boilers, with their contents, in the shape of many tons of water uselessly carried during the whole life of the ships; consequent on this, increased space and capacity available for freight-paying cargo, as for instance, affording the possibility of adopting single-ended instead of double-ended boilers, by which not only the reduced cubic capacity of the boiler itself but the whole of that of the stokehold is made available for ship's use.

"2. The maintenance of uniform pressure of steam under all conditions of weather or climate, or the working and cleaning of fires.

"3. The complete ventilation of the stokeholds and the engine-rooms in hot climates and under all weather.

"4. Greater control over the whole of the operations connected with the generation and maintenance of steam.

"Engineers are constantly asked, 'Will it not be wasteful of fuel and shorten the life of the boilers?'" Mr. Marshall would unhesitatingly answer, "No," to both these questions.

With regard to the first, due attention being had to the proper proportion of grate and heating surface and disposition of the same, no increased waste of heat should or will occur under any ordinary careful management.

The durability of locomotive boilers in which more than three times the quantity of fuel is consumed per square foot of grate, and in which the circulation of water is much less complete, and its quality generally much worse, is sufficient answer to the second question.

In regard to the weight of machinery required for the production of a given amount of power, there has been since 1881 but little progress made in the mercantile marine, except in few individual cases; and Mr. Marshall impresses upon shipowners and engineers generally the necessity of paying greater attention to this important subject. In all cases in which heavy dead-weight cargoes have to be carried, and judging from the great importance attached at the present time to the position of the load-line, it would appear that the majority of cargo vessels are engaged in dead-weight carrying. Every reduction in weight of propelling machinery and bunker coals means the increase of freight-earning power of the vessel. In the case of a vessel carrying a dead-weight cargo of 2500 tons, and having an indicated horse-power of 1000, her propelling machinery would weigh 204 tons. If this weight could be reduced by 25 per cent., it would mean that the vessel could carry 51 tons more cargo, that is to say, she would have an increase of carrying capacity of 2 per cent. As the working expenses would not be increased, this saving of weight would give a more than proportionate increase in the profits, whilst a larger reduction in the weight would give a still larger benefit.

War ships.

In war vessels the progress in relation to the rates of power and weight has been marked and continuous. It is clearly shown in the following particulars of machinery supplied to the British Admiralty:—

Vessel.	Date.	Indicated Horse-Power.	Weight of Engines per Indicated Horse-Power.	Weight of Boilers, including Water per Indicated Horse-Power.	Total Weight of Machinery per Indicated Horse-Power.
			lb.	lb.	lb.
Iris	1880	7,330	136	173	309
Canada . . .	1882	2,430	152	211	363
Satellite . . .	1882	1,400	134	177	311
Conqueror . .	1883	5,840	145	166	311
Colossus . . .	1884	7,490	151	178	329
Edinburgh . .	1884	7,520	143	169	312
Impérieuse . .	1885	10,180	130	140	270
Rodney . . .	1885	11,160	105	127	232
Leander . . .	1885	5,500	139	196	335
Mersey . . .	1885	6,630	82½	104	186½
Surprise . . .	1885	3,030	112	149	261
Scout. . . .	1885	3,370	78	116	194
Benbow . . .	1885	10,850	112	158	270
Howe . . .	1886	11,725	104	116	220
Calliope . . .	1886	4,024	113	175	288
Now building					
Racoon . . .	..	4,500	85	105	190
Medusa . . .	..	9,000	..	..	161
New Rattler. .	..	1,200	..	..	244
Daphne . . .	..	2,000	..	..	215
Sandfly . . .	..	3,000	..	..	82¼

Engines by Mr. Marshall's firm.

The following are similar particulars of engines made by Mr. Marshall's firm:—

Name.	Date.	Indicated Horse-Power.	Weight of Engine per Indicated Horse-Power.	Weight of Boilers and Water per Indicated Horse-Power.	Total Weight of Machinery per Indicated Horse-Power.
			lb.	lb.	lb.
Tsukuski . .	1881	2,887	147	115	262
Protector . .	1884	1,646	109	127	236
Esmeralda . .	1884	6,282	119	128	247
G. Bausan . .	1884	6,000	114	122	236
Naniwa . . .	1885	7,720	98	106	204
Panther . . .	1886	6,984	76	100	176
Dogali‡ . . .	1887	8,045	78	90	168
Isla de Cuba‡ .	1887	2,700	70	89	159
Tripoli† . . .	1887	4,200	34	50	84
Now building					
Sardegna‡ . .	..	22,800	83	95	178
Montebello‡† .	..	4,200	35	49	84
No. 2093‡ . .	..	4,200	60	74	134
Express* . .	..	2,800	145	128	273

* The Express is a merchant vessel intended to attain a speed of 17 knots.
† These vessels have each six locomotive boilers.
‡ These vessels have triple-expansion engines; all the others in the Table are two-cylinder compound.

"This result has been achieved in the boiler department principally by the more complete adoption of forced draught, whereby we now get 20 and even 22 indicated horse-power per square foot of grate, and in the engine department by use of higher speeds of piston and revolution, made possible by the more general employment of the high-class material now available for the construction of the engines."

American boilers.

In all these cases the heated gases pass through tubes exposed to the objections already stated. Many years ago the Americans devised a boiler in which the flame and heated gases were outside the tubes, and the inside of the tubes held water and were part of the general water space in which the steam was generated. Speaking of this system Mr. Sennett says, as the result of experience in our own Navy, with such boilers, that they gave economical comparative results when the tubes were clean and the fires were not forced, but when the fires were forced there was heavy priming, and the difficulty of cleaning and repair was very great. Moreover, there was considerable danger of choking with scale and burning, if salt water were used.

Tubular boilers.

Since this American vertical tube boiler was devised there have been many plans of boilers in which the firing is external and the water space consists of groups of tubes whose outer surface is exposed to heat. Such boilers are called tubulous, or sectional, or water-tube boilers. Mr. Perkins has employed one capable of delivering steam at a pressure of 500 lbs. per sq. inch.

The Herreshoff boiler is a continuous coil of tube arranged as a dome over the fire. Feedwater is pumped slowly through the coil, and it turns to steam before it reaches the end of the coil.

The most recent step in boiler construction is in this direction. To distinguish it from those in general use, which may be called gas-tube boilers, this boiler, like those just referred to, is a water-tube boiler.

The following description of this most successful boiler is taken from *Engineering*, July 22, 1887.

Thornycroft's water-tube boiler.

In our last issue we gave illustrations and a description of the Spanish torpedo boat Ariete, built by Messrs. Thornycroft and Co., a vessel which, it will be remembered, achieved the unprecedented speed of 26 knots on her trial trip. There is no doubt that this excessive speed was due in a large measure to the boiler with which this vessel was fitted, and when describing the boat we promised to give, later, fuller particulars of the steam generating apparatus. This promise we now fulfil.

Boilers of the Ariete.

The boilers of the Ariete are two in number, being placed front to front, so that the stoking space, 13 ft. 6 in. long, is between them and common to both.

Each boiler consists substantially of a horizontal drum or separator at the top, a large number of generating tubes, two horizontal cylinders placed in the wings of the furnace, from which the generating tubes spring, and two connecting pipes between the separator and wing cylinders. So long as there is any fire in the grate the water is constantly circulating through these parts, rising in the generating tubes and falling in the down-comer connecting tubes.

Referring to the illustrations, Fig. 1 is a front elevation of the boiler in position in the boat, Fig. 2 is a longitudinal sectional elevation, Fig. 3 is an elevation with the front removed, and Fig. 4 is a transverse section. The feedwater is first pumped into the separator or steam collector. This is the horizontal cylindrical vessel near the top of the boiler. From this lead the two down-comers, through which flows any water in the separator to the two wing cylinders placed at the sides of the grate. The normal level of the water is about half way up the separator. From the wing cylinders the water rises in the generating tubes to the separator, a greater or less proportion, according to the extent of the fire and volume of feed, becoming, in its passage, converted into steam. In order that the separator may properly perform its functions, it is necessary that it should not be subject to the heat of the furnace, and this fact to a great extent governs the shape of the generating

Thornycroft Water-tube Boiler.

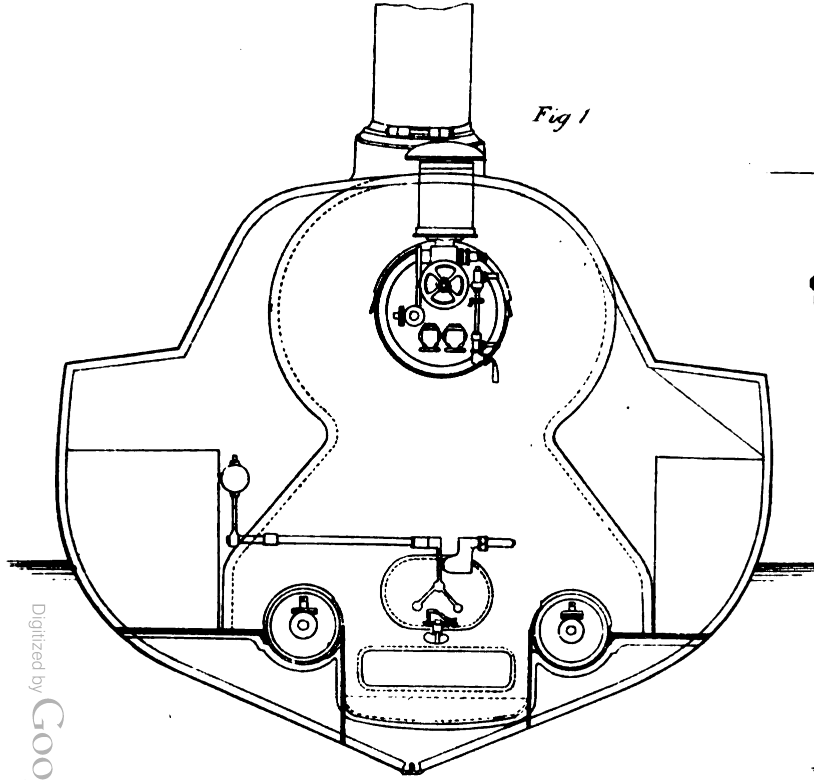

Fig 1

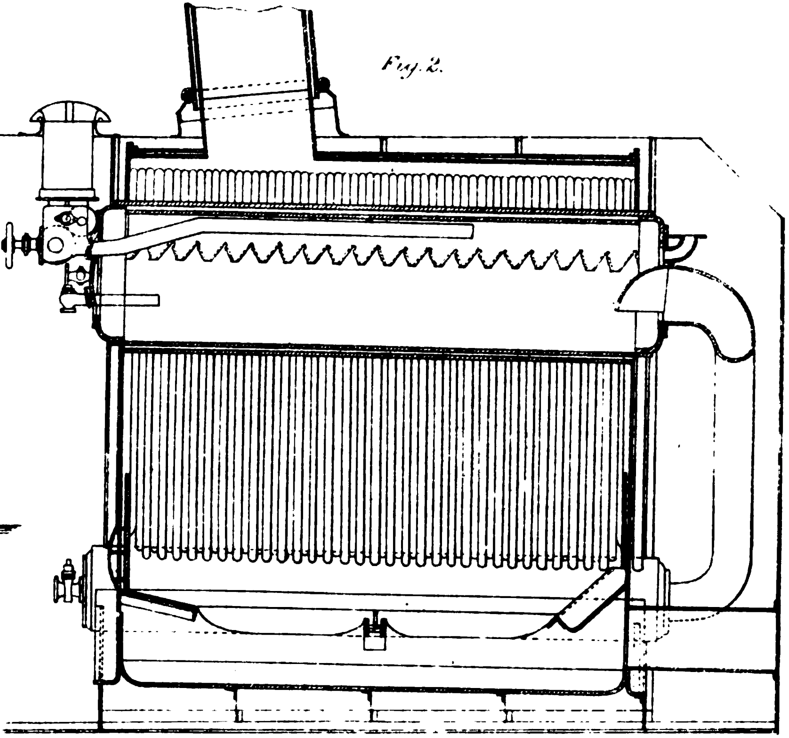

Fig. 2.

BRITISH SHIPS.

Thornycroft Water-tube Boiler.

Fig 3.

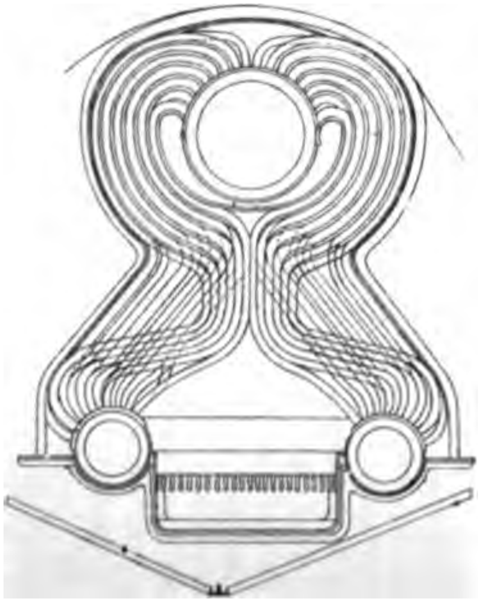

Fig 5.

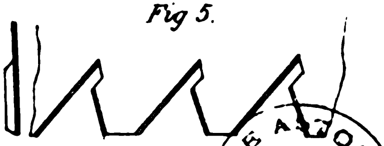

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Fig 6.

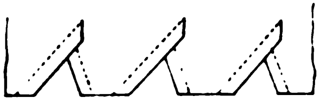
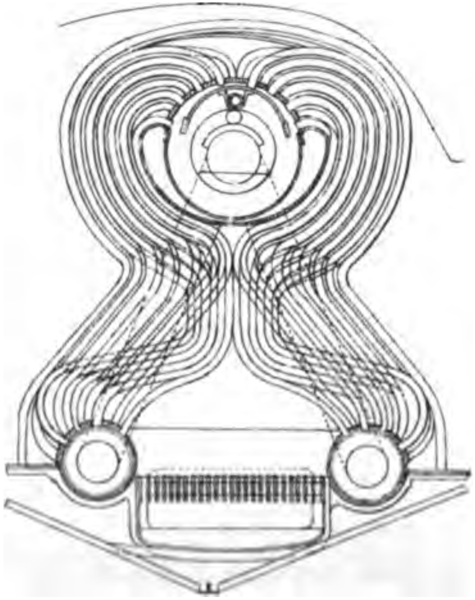


Fig 4.



tubes. Figs. 3 and 4 show the course they take in their passage from the wing cylinders to the separator. The greater number are arranged as shown in continuous full lines in Fig. 4, those in full lines in Fig. 3, and in partially dotted lines in Fig. 4, being only the two groups placed at each end, and which are bent differently to the rest, for the purpose of protecting the ends of the casing, as will be explained later. It will be seen then that the generating tubes spring from the wing cylinders. From thence they curve inwards over the furnace until the inner row of tubes of each side touch each other. The tubes then bend back again, and are curved round so that they ultimately enter the separator at the upper part. As all the tubes of the two inner rows touch each other, it will be evident that they form a continuous arch over the furnace, and the separator being above this, it naturally is shielded from the direct radiant heat of fire. In order, however, more effectually to protect the separator, it has on its underside a baffle composed of asbestos.

Having indicated the course of the water as it circulates in the boiler, it will be convenient to leave the subject for the present, in order to describe the course of the furnace gases and the products of combustion. In order to do this it is necessary to go more fully into the arrangement of the generating tubes. As may be seen by Fig. 2, the axis of each lies, when viewed in longitudinal section, in a vertical plane; that is to say, the pipes are only curved in cross-section. The generating tubes have to form a flue through which the products of combustion are conveyed to the chimney. There are eight rows of holes drilled in each wing cylinder, and eight corresponding rows in each side of the separator. As the tubes, which are of weldless steel, are expanded into the wing cylinders and separator, it is evident that the holes into which the tubes are expanded cannot be touching each other; but it is necessary that the outer rows of tubes should touch so as to form the close walls necessary to constitute an approximately smoke-tight flue, the gases of course ascending in the space between these walls. In order to arrive at this end the holes are spaced in each row their own diameter apart, any two rows thus forming a zig-zag. The tubes of the two outer rows of each cylinder are bent a few inches above the spot from whence they spring, so that they travel side by side, each one touching its neighbour, until they reach within a few inches from the separator, where they have to be bent apart again in order to enter the zig-zag row of holes provided for them in the separator. We thus account for four of the eight rows of holes in both wing cylinder and separator. The other four rows have tubes expanded into them, but these tubes are not bent so as to be brought into contact, but follow the course of the flue, the gases playing freely all round them. It will be evident that the number of these internal tubes is only limited by the possibility of their accommodation in entering the cylinders. They might be left out entirely without affecting the principle of the boiler, but in such a case the heating surface would naturally be very much curtailed. The tubes of the outer rows, which form the walls of the flue, not touching each other until within a few inches of the wing cylinders, there must of course be a triangular space left between each pair of adjacent tubes, and it is through these spaces that the gases pass into the tube-formed flue. The gases having ascended through the flue pass out through the corresponding spaces where the tubes enter the separator and from thence to the chimney. Such spaces as are not required for the passage of gases are stopped by fireclay or asbestos, and the outer casing, which forms a smoke jacket for the whole boiler, is protected by sheet asbestos, &c. The eight tubes at each end of the boiler are curved in such a manner as to shut in the front and back of the furnace, but the space that they cannot be made to cover is built up with firebrick. The wing cylinders are protected from the direct heat of the furnace by dwarf firebrick walls which form the side boundaries of the grate.

In any arrangement of pipe boiler the first point that any one who has had experience in such apparatus will look to, will be the provision made for circulation, for this is the rock on which most water-tube systems are wrecked. The Thornycroft boiler exists and flourishes on the priming which has proved the most serious defect in former water-tube boilers.

The more rapidly steam is generated in the tubes, and the more rapidly it drives the water before it into the separator, so much the more rapidly will the water flow down the "down-comers" and rise again in the circulating tubes. It may be objected that the generation of steam will cause a downward pressure towards the wing cylinders as well as an upward pressure towards the separator, in fact that the pressure will be balanced; but there is the difference in specific gravities of the mixed water and steam in the generating tubes and the solid water in the "down-comers," and this acts to promote energetic circulation. In any case, however, the working of the boiler in practical use is what will determine its value. On the trial trip of the Ariete enough was demonstrated to prove that the design is possessed of high merit. During the six runs on the measured knot the steam gauges showed very small fluctuations; a fact perhaps of less importance than the steadiness of the pressure when the boat was started after lying some time at Westminster. Again, when running lower down the river at moderate speed, a sudden and unexpected call was made for a much higher rate of steaming, and the fall of pressure was very slight, not sufficient to be of any considerable practical moment. On easing down after the runs on the knot the steam did not rise beyond a trifling extent, and although a relief valve is fitted between the boiler and condenser we believe it was not put into requisition. It would have been interesting to have stopped the boat suddenly when travelling at a fair speed, and to have started her again after an uncertain interval, but such experiments are not to be expected on an official trial trip, and we hope yet to have an opportunity of seeing manœuvres of this nature performed.*

The dryness of the steam delivered to the engines is a feature that requires consideration with boilers of this class, and in order to secure this end special provision is made. In Fig. 2 may be seen a serrated plate placed inside the separator. This is bent to a half-circle and lies just within the separator, as shown in Fig. 4. Into the semi-annular space thus formed between the separator and this baffle plate the generating tubes discharge their steam and water. The object of forming the edge of the baffle plate in the way shown is that the steam and water may be more effectually separated from each other. Fig. 5 shows the manner in which the notches are formed. A triangular piece is first taken out and the cut is continued as shown by the line. The edges of the notches are then bent so as to project at right angles to the rest of the plate. The lines at which they are bent are shown in Fig. 6 by the dotted line. This particular form of baffle plate is the result of a large number of experiments, and is found in practice to answer the purpose of separating the water from the steam very effectually. The water that is projected on to the plate rushes towards the notched edge until it meets the upturned part standing out to obstruct or deflect its course. It is then guided down to the lowest part or points of the serrations and falls to the bottom of the separator. On the other hand, the steam having less momentum than the water is more easily deflected from its course and passes round the small spaces at the top of the notches where there is no projecting guide plate, making the best of its way to the internal steam pipe, which is placed immediately beneath the baffle plate, as shown in Figs. 2 and 4, and which is provided with saw cuts in the usual way.

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* This boat has been stopped quite suddenly when running at full speed with 150 lbs. pressure in the boiler. The behaviour was exactly the same as that of the locomotive boiler. Steam escaped from the safety valves, but by opening the stokehold hatches to stop the forced draught, and letting steam straight into the condenser, the pressure did not rise in the boiler at all.

It will be seen that the introduction of the Thornycroft water-tube boiler constitutes an important step in the history of torpedo boat construction. During the past few years the principles on which the steam machinery of these boats is designed have been more or less adopted in larger war vessels, and progress in the same direction is still going on. It is, therefore, not by any means improbable that if the Thornycroft boiler can, with advantage, replace the locomotive type in torpedo boats—as certainly appears probable—the matter may not end there, and this new boiler may meet with a far more extended application.

Improvements in ordinary boilers.

The ordinary boiler has gained greatly in strength by the use of steel in forming the shell, and by employing corrugated furnaces. They can now carry from 150 to 180 lbs. of steam per square inch safely. By careless treatment, the corrugation in these furnaces is sometimes filled up solid with lime and scale, and thus the furnace may collapse. To meet this difficulty, the firm of Sir John Brown and Company of Sheffield, make a strengthened corrugated flue in which the liability to choke is said to be reduced.

It should be stated that by the adoption of a more economical system of distillation of water it is becoming profitable to make up waste in ordinary gas-tube boilers with fresh water distilled in the ship. Thus one of the objections to the water tube systems is removed.

The following extract from *Engineering* of July 22, 1887, gives an interesting case of the successful adoption of forced draught on Mr. Howden's system.

Trial trip of the Ohio.

Some important trials of the new machinery of the screw steamer Ohio, belonging to the International Navigation Company, have recently taken place on the Clyde. The Ohio is an American built steamer, measuring 343 ft. by 43 ft. by 34 ft. 6 in., and of 3325 tons gross. She has been entirely refitted with new engines and boilers by Messrs. James Howden and Co., Glasgow, who also rearranged the bunker, machinery, and hold spaces, so as to give the important advantage of increased cargo accommodation obtainable from the use of their improved machinery, which occupies considerably less space than the engines and boilers of the same power which have been replaced. The new engines are of the triple expansion type, and the boilers, which are designed for supplying steam of 150 lb.

pressure, are worked on Howden's system of forced draught, which combines increased power with high economy in fuel. The object of the owners in refitting the Ohio was to test the capability and economy of this system of forced draught on a sufficient scale to guide them in dealing with steamships of the largest class and great power.

In the refit of the Ohio the boilers were designed to work with a very moderate air pressure, this being sufficient for the power required by the contract. The combined power and economy, however, guaranteed by Messrs. Howden and Co. for the use of their system of forced draught was higher than has hitherto been attempted in any steamship, and sufficient, if attained, to prove the large reduction that could safely be made in the number and size of boilers for the use of the system, and the quantity of coal required to produce a given power. The contract for the refit of the steamer required that 2100 indicated horse-power (which was the maximum power of the engines removed) should be maintained during the trial on a consumption of 1·25 lb. of coal per indicated horse-power per hour. Originally the boilers of the Ohio, from which this power was produced, were three in number, double-ended, 12 ft. 6 in. in diameter by 17 ft. 6 in. in length, having each six furnaces 3 ft. in diameter, or eighteen furnaces in all, with an aggregate fire-grate area of 300 square feet. The new boilers, fitted with the forced draught, are likewise three in number, but single-ended, 13 ft. in diameter by 11 ft. 2 in. in length, having each three furnaces 3 ft. 3 in. in diameter, or nine furnaces in all, with an aggregate fire-grate area of 112 square feet. Air for combustion is supplied to the boilers by one of Messrs. W. H. Allen and Co.'s fans, 5 ft. 6 in. in diameter, driven direct by an engine having a cylinder 7 in. in diameter with stroke of 4 in. The boilers removed had two stokeholds across the ship, one fore and one aft of the boilers, while the new boilers have only one stokehold on the after side. The engines removed have cylinders 57 in. and 90 in. in diameter, by 48 in. stroke, while the new engines have three cylinders 31 in., 46 in., and 72 in. in diameter respectively, with piston stroke of 51 in.

During the trials the coals were weighed out under the supervision of the officers of the company, who also took the record of speed and other data. After running down Channel for a considerable time, the trial on the coals weighed out began, and lasted 4 hours 10 minutes, during which time 10,885 lbs. of Welsh coal were burned, the trial ending with the same revolutions of engines and the same pressure in boilers with which it began. The mean indicated horse-power calculated from the mean of seven sets of indicator cards, taken during the trial, and the mean revolutions per minute, found by dividing the total revolutions recorded on the engine counter by the minutes in the period of the trial, amounted to 2124, thus making the consumption 1·23 lb. per indicated horse-power per hour, and the power per square foot of fire-grate almost exactly 19 indicated horse-power.

3. Engines.

In 1872, the working steam pressures in marine engines ranged from 45 lbs. to 65 lbs. (averaging 52·5 lbs. per square inch), the latter being the highest pressure recorded in the tables published by Sir F. Bramwell in that year. The average piston speed was 376 feet per minute. The average consumption of fuel in nineteen of the vessels referred to by him was 2·11 lbs. of coal per I.H.P. per hour.

Papers by Mr. Marshall.

In 1881, Mr. F. C. Marshall (summarizing results) stated that the average consumption of fuel had been reduced to 1·828 lbs. per I.H.P. per hour. The marine engine had not altered in character since 1872. It was still the compound two-cylinder vertical engine, with receiver, and with two cranks at right angles, but the steam pressures were much higher; the boilers had less heating surface, and the cylinders were smaller in proportion to the power developed. The mean working pressures in 38 ships specified had gone up to 77 lbs. above the atmosphere. In one case it was as high as 100 lbs. The piston speed had been raised from 376 feet to 467 feet per minute.

Writing in July 1887, Mr. Marshall says: "In the six years that have since passed very great progress has been made in all these points. As regards economy of fuel the greatest step taken has been the introduction of the triple expansion engine," "which has come to be practically universally adopted for all new merchant steamers, as well as for all new war vessels," with 150 lbs. the normal working pressure. The average consumption of fuel had fallen to 1·512 lbs. per I.H.P. per hour with triple expansion engines, against 1·955 lbs. with ordinary two-cylinder compound engines in vessels engaged in similar trades.

Mr. Marshall goes on to say:—

"The advantages of triple-expansion engines as compared with compound engines, and also the elasticity of power produced by artificial draught, are admirably illustrated by the performances of the triple-expansion engines of the Dogali built and engined in this country for the Italian Government, and of those of the Panther and Leopard for the Austrian Government. The last-named vessels are fitted with compound engines, and their boilers are exactly duplicates of those of the Dogali, except that they were worked at 90 lb. per square inch instead of 150 lb. The maximum power they developed was 6984 horses under forced draught, and 4600 horses under natural draught; while the Dogali developed 8045 and 5347, an increase of about 16 per cent., due to the higher pressure, and in each case an increase of over 50 per cent. in the power obtained by forced draught over that obtained by natural draught.

"The greatest power put into one vessel previous to 1881 was, I believe, about 8000 in the cases of the Dandolo, Duilio, Inflexible, and Amiral Duperré. In 1881 and 1882 the engines of the Italia and Lepanto were being constructed, having a power of 18,000, an enormous advance being thus made at one step. So far, our own Admiralty have not considered it wise to adopt powers of such magnitude, being content with 11,500 and 12,000 in our largest vessels. The Italian Government have now, however, in course of construction the Re Umberto and Sicilia, each with a power of 19,500 horses, and the Sardegna, with a power of 22,800. The Sicilia and Re Umberto are twin-screw armourclad vessels, and their engines are of the double expansion compound type—two sets of engines to each propeller shaft—the cylinders of which are 47 in. and 89 in. in diameter respectively, with a stroke of 51 in. In the case of the Sardegna the engines are being built by the Hawthorn Guppy Company, of Naples, from designs by Mr. Marshall's firm, and consist of two sets of triple expansion engines for each screw, having cylinders 39 in., 59 in., and 88 in. in diameter respectively, and 51 in. stroke.

"These engines are so designed that the forward sets in each case can readily and quickly be disconnected from the others, so that when cruising at low speeds the after engines only need be used, and thus more economical results may be obtained than would be possible with all the engines at work.

"In these engines, as in most of those of modern war vessels, the whole of the pumps are entirely independent of the main engines and all are in duplicate, each pump being driven by its own independent engine. Each of the four sets of main engines has its own combined steam and hydraulic reversing engine, and these are so arranged that those of the engines working on one screw may be coupled together or disconnected at will in a similar way to that adopted for disconnecting the shafts, so that in case of mishap to one reversing engine, the other coupled to it may be used to control either or both of the coupled sets of engines.

"The boiler power consists of 18 return-tube boilers, having each four furnaces. They are arranged in six separate water-tight compartments—four forward and two aft of the engine rooms. The working pressure is 150 lbs.

"Some idea of the magnitude of the motive power of this vessel may be formed from the fact that it consists of 62 engines, having 90 cylinders, in all representing a collective area of 47,466 square inches, or a cylinder of 20 ft. 6 in. in diameter. The propelling engines will be worked at a piston speed of 1020 ft. per minute, and will constitute the largest propelling power ever introduced into any vessel, either for war or mercantile purposes."

As regards torpedo boats and torpedo cruisers much also has been done; in fact, the latter class of vessel has been called into existence during the last six years. These vessels in which the weight of the propelling machinery constitutes the greatest part of the total displacement, are, up to the present time, the only type of sea-going vessels in which our Naval constructors have ventured to adopt the modified locomotive type of boiler. With this type of boiler, worked with an intense draught produced by fans, and with high-speed engines of specially light construction, enormous powers have been developed upon light weights of machinery.

4. PROPELLERS.

Propellers.

The success of twin-screws as a means of applying increased engine power and the recent increases in power have led to the introduction of three screws.

Italian ships—Folgore and Tripoli.

Speaking of the Italian ship Folgore, Mr. Marshall says that this ship was fitted by him with twin-screw engines, and the Tripoli with triple screw engines. Each screw was driven in both cases by a pair of compound engines with cylinders 19½ in. and 35 in. by 16 in. stroke. The Tripoli has obtained a speed of 21 knots, and the Folgore a speed of 22·8 knots. In neither case were the engines run at their full power, owing to the excessive vibration of the ship when the engines were run at their greatest speed, viz. about 360 revolutions per minute. The ship's period of vibration is 120 per minute, and excessive vibration occurred when the number of revolutions of the engines was about 240, and also when it was about 360. In the trial it was not deemed prudent to run the engines faster than 330 revolutions.

The Tripoli is being followed by the Montebello and Monzambano, each with three screws, but fitted with triple expansion engines, having cylinders of 15½ in., 24 in., and 37 in., by 16 in. stroke. In these vessels the outer screws are arranged similarly to those of an ordinary twin-screw ship, while the centre screw is carried much lower than the others, the shaft emerging at the stern just above the line of the keel, and passing beneath the rudder. The blades of these screws, therefore, project below the line of keel. In all cases each screw-shaft is made with a disconnecting arrangement, so that when cruising at less than full power either of the outer engines or the centre engine may be worked alone, the propellers of the others being free to revolve. These engines are supplied with steam from two boilers to each engine, or six in all.

The results of some trials made with one, two and three screws respectively are very interesting. They are, perhaps, not strictly comparable, as, owing to local circumstances, they were each made with different screws. The trials of one and two propellers being made with the same screws, only slightly reduced in diameter for the two-screw trial, while the three-screw trial was made with propellers of larger diameter and greater pitch. Moreover, as we have not corresponding records of the powers required to drive the vessel the same speeds with all three screws, we cannot estimate precisely the propulsive efficiency of one or two screws as compared with the three screws, but it is interesting to note that the efficiency of the single screw is by no means so small as might have been supposed, considering its small size. The results are given in the following Table:—

TABLE showing RESULTS of TRIALS made with ONE, TWO, and THREE SCREWS, in the ROYAL ITALIAN TORPEDO CRUISER, TRIPOLI.

Number of Screws used.	Diameter of Screw.	Pitch.	Surface.	Mean Revolutions per Minute.	I.H.P. Mean.	Speed Mean.	Slip.	Mean Draught.	Displacement.
	ft. in.	ft. in.	sq. ft.				p. cent.	ft. in.	tons.
1	5 3	6 1¼	7·15	356	1,030	14·55	32·	9 10¾	770
2	5 1	6 1¼	6·52	383	2,076	18·33	18·6	10 2⅜	802
3	5 9	7 1½	7·57	297	3,016	19·8	5·25	10 5½	831

Length of vessel, 230 ft.; breadth, 26 ft.

CHAPTER XV.

NAVAL INCIDENTS.

FRENCH SQUADRONS, 1886.

French Squadrons.

THE scheme of operations, as indicated by the French journals, embraces tactical evolutions by the squadron accompanied by a flotilla of some thirty first and second-class torpedo boats, experiments to test the efficiency of torpedoes and torpedo nets, and a determination of the relative value of torpedo boat and cruiser against armourclads, with a view to reforming the French naval policy.

The scheme also contemplates the blockade and attack in force upon one of the French ports, the landing of the naval brigade, and experiments with torpedoes and explosives on shore.

Torpedo Attacks.

On the 2nd of March, the Amiral Duperré and torpedo boats 58 and 59 (61 feet long, 11 tons, second class) and 63 and 64 (108 feet long, first class) engaged in torpedo practice. The first experiment was made by the Duperré, passing at full speed across the fire of 58 and 59. The boats were stationary and held in position by three cables. As the Duperré crossed their line of fire at a speed of 14 to 14½ knots, six torpedoes were discharged at different angles to her course, and it is reported that all hit the ship and exploded their fuzes.

In the second experiment both boats and ships were under way. No. 58 and the Duperré approached each other, bows on, at a combined speed of about 23 knots. At a distance of 450 metres the boat fired its torpedo, which struck the Duperré 11 metres abaft the spur and exploded its fuze.

Nos. 63 and 64 each fired a torpedo under similar circumstances. The speed of the boats was 12 knots, while that of the Duperré was 14. The torpedo of No. 63 struck, though it is doubtful if it would have exploded its charge. No. 64 failed to hit the ship.

The *Temps* states:

From the Amiral Duperré it was observed that in these shots the

French Squadrons.

trajectory of the submarine machine underwent no deviation on approaching the ironclad. The wave of water formed in front of a great ship at full speed has then no effect on the direction of the torpedo encountering it. Consequently it may be held as established that the English experiment at Bantry Bay is valueless, whether owing to the facts not being well understood or to the English torpedoes being badly equipped or unskilfully worked. Contrary to what has been stated on the other side of the channel, a large vessel cannot rely on the displacement of the water caused by its advance to change the direction of the torpedo.

On the 3rd March in Hyères Roads, the Amiral Duperré simulated an attack with the aid of torpedoes against an enemy's ship, represented by a floating target, towed by the Robuste. After firing torpedoes at this target (the result of the firing is not known), torpedo boats 58 and 59 made an attack upon the Duperré, which opened a heavy cannonade upon them. The boats approached within torpedo range and fired at the ship. One of the torpedoes thus fired gave evidence of having struck its mark.

The trials of the 2nd and 3rd March demonstrate, according to the *Temps*, that a torpedo well directed and properly discharged at a distance of 400 or 500 metres against a vessel proceeding at the rate of 15 knots will certainly hit it under ordinary conditions, whether directed against its bow or sides.

Attack on Armide.

The old armoured ship Armide, now condemned, was placed at the disposal of squadron for torpedo and target practice. On the 24th March she was towed to the Golfe Juan, and having been cast adrift, the Colbert, Amiral Duperré, Friedland, Dévastation, Redoutable, and Suffren engaged in firing at her during a part of the day with their 14, 24, 27, and 32-centimetre guns, at ranges varying from 3000 to 5000 metres. The squadron during the practice steamed in column of vessels, and first fired the main deck guns at 3000 metres' range, and afterward the heavier barbette guns at 5000 metres.

The target offered by the Armide's port broadside was about 230 feet long, with a height of about 23 feet.

The results were as follows: Twenty-nine projectiles struck the armoured belt, 4 of which, being of heavy calibre, perforated it, and 25 shots from the 14-centimetre guns struck the wood sheathing which had formerly separated the armour from the copper. The four heavy projectiles crushed the ship's side. One of the holes made by a 34-centimetre projectile exposed a surface of about 20 square feet; 84 holes were counted in the upper works; 27 shells passed through the ship's side without exploding. Out of 615 shots fired, there were

French Squadrons.

at least 140 hits, or 22 per centum of the whole number fired. Beyond the limits of the armoured citadel the ship would have been uninhabitable, for the sides, bridge, armoured conning tower, and the port barbette tower were completely riddled.

All the projectiles used, with the exception of one round from a heavy gun, were of cast iron, which accounts for the lack of penetration of most shots striking the water line armour belt (5 to 6 inches, iron).

Considering the range (3000 to 5000 metres), and the fact that the vessels engaged were under way, the firing must be considered as excellent. The ordnance-equipment and ammunition is said to have been very satisfactory.

The Armide was towed into Toulon after the more serious wounds had with some difficulty been patched. It is probable that she would have sunk during the exercise had not the holds been filled with empty barrels to prevent such an accident.

Exercises at torpedo firing against moving objects, practice with the Hotchkiss revolver-cannon from vessels under way, and searching with the electric search-lights were continued by the squadron.

Attack by torpedo boats on ironclads.

About the middle of April a portion of the torpedo boats left Toulon in company with the Fulminant and Aréthuse. After different exercises, the Fulminant was sent 6 or 7 miles ahead of the Aréthuse, near which were the torpedo boats in groups of fours. After dark one group was sent to find the Fulminant, but failed to do so. The second group was then sent forward, and after several hours the armourclad was found by one of the boats. The night was dark, the weather bad, and rainy, and the sea heavy, which made the circumstances of the search difficult. The Fulminant, however, did not mask her lights on this occasion.

This short cruise of twenty-seven hours, in an ugly sea off Toulon, is reported by the correspondent of *Le Yacht* to have completely used up the crews of the torpedo boats.

GRAND NAVAL MANŒUVRES.*

FIRST PERIOD.

The vessels engaged were as follows:—

Armoured.

French Squadrons. Grand Manœuvres, 1886.

Colbert.—Armoured battle-ship; launched, 1875; displacement, 8457 tons; battery, eight 10⅜-inch B.L., two 9·5-inch B.L., and six 5·51-inch B.L.; maximum speed, 14·5 knots; I.H.P., 4650; complement, 702.

Amiral Duperré.—Armoured battle-ship; launched, 1879; displacement, 10,487 tons; battery, four 13·4-inch B.L. and fourteen 5·51-inch B.L.; maximum speed, 14·5 knots; I.H.P., 8010; complement, 850.

Friedland.—Armoured battle-ship; launched, 1873; displacement 8540 tons; battery, eight 10⅜-inch B.L. and eight 5·51-inch B.L., maximum speed, 13·3 knots; I.H.P., 4428; complement, 700.

Dévastation.—Armoured battle-ship; launched, 1879; displacement, 10,000 tons; battery, four 13·4-inch B.L., four 10⅜-inch B.L., and six 5·51-inch B.L.; maximum speed, 15·2 knots; I.H.P., 8000; complement, 600.

Redoutable.—Armoured battle-ship; launched, 1876; displacement, 9200 tons; battery, eight 10⅜-inch B.L. and six 5·51-inch B.L.; maximum speed, 14·7 knots; I.H.P., 6071; complement, 700.

Suffren.—Armoured battle-ship; launched, 1870; displacement, 7604 tons; battery, four 10⅜-inch B.L., four 9·5-inch B.L., and six 5·51-inch B.L.; maximum speed, 14·3 knots; I.H.P., 4181; complement, 778.

Fulminant.—Armoured battle-ship; launched, 1877; displacement, 5580 tons; battery, two 10⅜-inch B.L. and four 4¾-inch B.L.; maximum speed, 13·2 knots; I.H.P. 3550; complement, 248.

Marengo.—Armoured battle-ship; launched, 1869; displacement, 7187 tons; battery, four 10⅜-inch B.L., four 9·5-inch B.L., and seven 5·51-inch B.L.; maximum speed, 13·5 knots; I.H.P., 3673; complement, 750.

Vauban.—Armoured cruiser; launched, 1882; displacement, 5900 tons; battery, four 9·5-inch B.L., one 7·5-inch B.L., six 5·51-inch B.L.; maximum speed, 14·32 knots; I.H.P., 4475; complement, 450.

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* From the French Journals, chiefly *Le Yacht*.

Unarmoured.

French Squadrons. Grand Manœuvres.

Aréthuse.—Double-decked barbette cruiser; launched, 1882; displacement, 3360 tons; battery, four 6·3-inch B.L. and twenty-three 5·51-inch B.L.; maximum speed, 16 knots; I.H.P., 4200; complement, 450.

Milan.—Despatch vessel and rapid cruiser; launched, 1884; displacement, 1550 tons; battery, five 3·94-inch B.L.; maximum speed, 18·4 knots; I.H.P., 4132; complement, 150.

Dupetit-Thouars.—Light barbette cruiser; launched, 1874, displacement, 2000 tons; battery, ten 5·51-inch B.L.; maximum speed, 15 knots; I.H.P., 2018; complement, 206.

Desaix.—Single-decked barbette cruiser; launched, 1866; displacement, 1683 tons; battery, four 3·94-inch B.L.; maximum speed, 14·21 knots; I.H.P., 1442; complement, 159.

Couleuvrine.—Torpedo despatch vessel; launched, 1885; displacement, 320 tons; battery, two 3·54-inch B.L. and three H. R. C.;* two under-water launching-tubes; maximum speed, 18 knots; I.H.P., 1800; complement, 77.

The grand manœuvres began on the 10th of May, and the neighbourhood of Toulon was the scene of operations. For the time being the fortifications of Toulon were supposed not to exist, the port and roads being defended by the torpedo division only, as indicated by the first theme.

As no map accompanies this account, it may be well to describe briefly the locality. The inner port of Toulon is nearly landlocked, and the entrance to it is closed by a jetty or breakwater. The outer roads, extending in a W.N.W. direction, are about two miles wide, one mile long on the south-western, and about two miles long on the north-eastern side. Cape Sepet is the headland marking the western side of the entrance to the roads, while Point Querquerane marks the eastern limit. Cape Brun lies on the north shore, nearly north of Cape Sepet, and about two miles east of the jetty. The Golfe de Giens lies just east of Point Querquerane, and at its southern limit are the Fourmigues Rocks, 4 miles south-east from the same point. Hyères Roads are some 12 miles from the Toulon jetty, and are separated from the Golfe de Giens by a narrow strip of land.

Cape Sicié is a headland about 5 miles west of Cape Sepet.

The armourclad squadron, under the command of Vice-Admiral Lafont, was divided into two divisions:

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* H. R. C.—Hotchkiss Revolving Cannon.

French Squadrons. Operations at Toulon.

First division.—Colbert (flag-ship), Amiral. Duperré, Friedland, Marengo, Milan (cruiser), and torpedo boats Nos. 74 and 70.

Second division.—(Rear-Admiral Rallier).—Dévastation, Redoutable, Suffren, Vauban, Hirondelle (cruiser), and torpedo boat No. 71.*

Division of torpedo boats (Rear-Admiral Brown de Coulston).—Desaix, Aréthuse, Dupetit-Thouars (cruiser), the Fulminant (armoured), and seventeen torpedo boats; twelve first-class boats of about 108 feet, and five second-class, of about 89 feet.

The squadron took station outside; the division of torpedo boats inside, behind the jetty. The Fulminant was moored at the entrance to the inner port, close to the jetty.

The following themes indicate the nature of the operations and the methods observed in conducting them:

First theme.—Can a squadron of armourclads approach by day and bombard a commercial or military port defended by a flotilla of torpedo boats?

Second theme.—Can a division of cruisers, accompanied by torpedo boats, force a blockade maintained by a squadron of armourclads?

Third theme.—Can a squadron of armourclads at sea, *en route* between Algeria and Toulon, be discovered and reached by a flotilla of torpedo boats?

Rules to be observed during the Manœuvres.

All vessels forming part of the squadron, *contre-torpilleurs* (torpedo boats accompanying the armourclads) included, will carry their running-lights at night. The enemy's (attack) torpedo boats will not display their lights. Any ship placed *hors de combat* will hoist at the mizzen a flag or lantern to indicate this. These signals will be displayed during the entire time that the vessel is considered out of action.

Any torpedo boat of the enemy found in any creek or indent of the coast by any vessel of the squadron will be considered as captured and sent to Toulon with a paper indicating its capture.

A torpedo boat will be *hors de combat* (1) if it has been under the fire of 50 rounds of the Hotchkiss revolving cannon before being in position to discharge its torpedo; (2) if it has been under the fire of a single round from any other gun, provided the torpedo boat has been seen at a distance of less than 500 metres, and in the prolongation of the line of sight of this gun which has been previously laid

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* The torpedo boats of the squadron were supposed to be torpedo-catchers (*contre-torpilleurs*), or torpedo gunboats.

French Squadrons. Attack on Toulon.

for a given direction and range, in expectation of an attack from torpedo boats.

Any armourclad not protected by its nets will be considered as out of action if it receives the fire of two torpedoes discharged by a torpedo boat in good position at a distance of less than 400 metres.

Any armourclad protected by its nets will not be considered as vulnerable except at the bow and stern; at the bow, under the conditions defined in last paragraph; at the stern, if the torpedo boat has been able to approach and discharge its torpedo within short range of the armourclad.

Any cruiser will be considered as captured if for one hour, at least, it remains under the fire of an armourclad at a range of less than 2000 metres, or if the vessel chasing shows a superiority of speed over that of the ship chased such that it can be overtaken one hour before nightfall.

Operations beginning on the 10th May, the electric lights were used from the shore, and all vessels and boats kept under steam at *all* times.

May 10.—The squadron cruising outside Toulon, standing off and on the entrance to the port. Fine weather. Smooth sea.

May 11.—Squadron off the entrance to port. Toward noon passed the entrance in column of vessels after having searched the coast by means of its cruisers and torpedo-catchers. The torpedo boats did not go out. Wind fresh from N.W. The squadron might have readily bombarded Toulon from two favourable positions.

May 12.—Nothing of interest occurred.

May 13.—Fresh breeze from the S.E. Heavy sea breaking over the jetty or breakwater. Foggy. The squadron formed by divisions in two columns, the vessels of second column opposite the intervals of the first, and stood in toward the port. When five miles to the southward and westward of Cape Sepet, the squadron cleared for action, and the second division was ordered to proceed to the Gulf de Giens, a few miles to the eastward of the entrance to Toulon Roads. In column of the first division crossed the entrance to the roads to the eastern shore, when the head of column changed course eight points to port (N.W.), and steered so as to pass to the westward of Cape Brun. The column again changed direction to port (S.W.), and steamed in a direction parallel to the jetty, to which it was now quite close, and opened fire.

The Fulminant opened fire upon the squadron, and the torpedo

French Squadrons. Attack on Toulon.

boats coming out through the jetty channel, a general engagement ensued. Some torpedo boats, masked by the Fulminant, charged the Marengo, the rear vessel of the column, which received them with a heavy fire of great and machine guns. The state of the sea was such that the torpedo boats could not have properly discharged their torpedoes. It is said that it would have been dangerous to open the tubes.

The time of attack was well chosen, and would probably have been successful, as the torpedo boats were placed at great disadvantage, attacking by day and in a heavy sea.

The following are given in *Le Yacht* as observations worthy of notice:

On the evening of the 10th we went out of Hyères Roads, about 10 o'clock. I am firmly of the opinion that the reflection of the moon upon the ripple of the water would have made it impossible to make out a torpedo boat at more than 600 metres. On the 12th there was a night alarm. The sea was absolutely smooth. It would have been possible to distinguish, toward 2 o'clock A.M., a torpedo boat coming from the eastward without lights; but in the west the sight was limited to a few hundred metres, and a silent torpedo boat could have surprised us.

On the day of the attack upon Toulon I am firmly of the opinion that our torpedo boats could not steer in the rather rough cross-sea without reducing speed. As soon as 10 knots speed had been passed the bow disappeared under the sea, the stern lifted, and the boat tended to come head to wind.

This concluded the operations under the first theme.

For the second theme the operations were naturally conducted in a different manner. The crews were divided into three watches, so that a constant and effective lookout and preparation was not fatiguing. The cruisers and torpedo-catchers were at daylight sent to a neighbouring bay (Hyères), so that the crews might obtain necessary rest. At night two of these boats were on the picket-line, while the third remained at its anchorage. On board the armourclads two lieutenants were constantly on duty.

In the daytime the squadron cruised in column of vessels, in open order, at low speed. At night it was formed in three lines, as follows:

First line.—The Milan, under Cape Sepet, with its torpedo-catcher; the Hirondelle, at the other side of the entrance to roads, with a second torpedo-catcher.

French Squadrons. Attack on Toulon.

Second line.—Five armourclads with their nets down, describing, about a point fixed by cross-bearings, circles of 1200 to 1500 metres diameter. Each day the direction of motion was changed to disconcert the enemy. The second line extended from Cape Sicié to the Fourmigues, a distance of about 7 miles.

Third line.—The armourclads of high speed, the Duperré, Redoutable, and Dévastation, held in readiness to give chase to any vessel running the blockade.

The incidents of this part of the operations were varied by frequent night attacks of torpedo boats and attempts on the part of the cruisers to escape. The torpedo boatmen claim many ships destroyed; but, on the other hand, it is averred by the officers on board vessels of the squadron that in many, if not most, cases the torpedoists were over sanguine, and discharged their torpedoes beyond effective range, and under circumstances of sea and weather altogether unfavourable and prejudicial to good firing. It is stated by those in the armoured vessels that the torpedo boats signalled discharges of torpedoes when at a distance of more than 1000 metres; and as the opportunities of estimating distances from the armoured vessels were much the best, this statement is instructive as illustrative of the difficulties under which an officer in charge of a torpedo boat in a seaway must act.

On the night of the 17th the attempt to pass the blockade was made. The Fulminant, Aréthuse, Dupetit-Thouars, and eleven torpedo-boats were under steam, ready to move. The weather was calm though somewhat foggy, and the sea smooth.

The Fulminant, in company with seven torpedo boats, passed along the shore of Cape Sepet, drove off the Milan, and allowed the boats to gain the offing. The Aréthuse, Dupetit-Thouars, and four torpedo boats skirted the eastern shore under the shadow of the land. These were discovered by the squadron and kept in view by the electric lights. By the skilful handling and feints of the Aréthuse which drove off the Hirondelle and her torpedo-catcher, and drew the attention of the armourclads, and the attacks of the torpedo boats upon the Marengo and Suffren, the Dupetit-Thouars slipped through the line, though in doing so she was under the fire of the Marengo, which fired at her fourteen rounds from her 24-centimetre and eight from her 14-centimetre guns. At one time the range was less than 1000 metres. The plan of the attack was well carried out. The Fulminant and Aréthuse engaged the attention of the inner lines, while the torpedo boats attacked and perplexed the movements of the

French Squadrons. Attack on Toulon.

outer lines of armoured vessels. While the Dupetit-Thouars escaped it is probable that in actual war she would have been seriously damaged, as she was in the beam of the squadron's search-lights, and under its fire for some time.

The lessons in tactics thus far to be drawn from the yet unfinished manœuvres lie in the study of the formation of the French squadron for attack on May 13, and in the carefully devised plan of maintaining the blockade, as well as the formation and movements of the torpedo flotilla. The torpedo boats were divided generally into groups of fours. They were manœuvred in groups by the steam whistle, which was given a different note in each boat of a group. The boats were also distinguished in groups by different colours—white, black, green, &c.

They were always accompanied by a heavy vessel, and moved under her cover until the moment of attack, when they dashed forward upon the object of their search. The experience gained during two months of constant torpedo boat work was noticeable in the increased skill and endurance shown by the crews of all the boats.

The first period of the operations of the French squadron of evolutions in May 1886, detailing the gathering together of vessels at Toulon from the different ports of France, the rules governing the actions of ships and boats, and the manœuvres which took place off Toulon, is described in the above account.

The first period of the grand manœuvres was divided into two parts or themes:

(1.) Toulon not being defended by batteries or mines, but by a flotilla of torpedo boats only, can a squadron of armoured vessels bombard the place with impunity?

(2.) A squadron of armoured vessels blockades the port of Toulon, in which is found a flotilla of torpedo boats, three cruisers, and an armoured coast-defence vessel; can it prevent the forcing of the blockade?

SECOND PERIOD.

First theme.—A squadron of armoured vessels at anchor on the coast of Provence receives an order to double Cape Corso; a flotilla of torpedo boats supported by a coast-defence vessel and three cruisers will endeavour to stop it, to destroy it if possible, and finally to pursue it.

French Squadrons. Operations off Corsica.

The vessels engaged were as follows:—

Admiral Lafont's squadron.

Vessels.	Launched.	Maximum speed.
		Knots.
Amiral Duperré	1879	14·2
Dévastation	1879	15·2
Vauban	1882	14·3
Redoutable	1876	14·7
Colbert (Flag)	1875	14·5
Friedland	1873	13·8
Richelieu	1873	13·1
Suffren	1870	14·3
Marengo	1869	13·5
Couleuvrine (unarmoured torpedo despatch vessel)	1885	18·0
Milan (cruiser)	1884	18·0
Hirondelle (despatch vessel)	1869	15·5
2 torpedo boats.		

Admiral Brown's Division.

Vessels.	Launched.	Maximum speed.
		Knots.
Fulminant (armoured coast-defence vessel)	1877	13·2
Aréthuse (cruiser)	1882	14·0
Dupetit-Thouars (cruiser)	1874	15·0
Desaix (cruiser)	1866	14·2
20 torpedo boats.		

Admiral Lafont was in the Gulf Jouan (near Cannes) when the commencement of operations was announced, June 2. From this time seventy-two hours were allowed him to double Cape Corso and continue his route to the anchorage of Ajaccio, passing to the eastward of the island of Corsica and through the Straits of Bonifacio; thus circumnavigating the island.

Admiral Brown had gone to Villefranche from Toulon, leaving two groups (four each) of torpedo boats at Antibes. Then gathering his entire force he proceeded, on the 1st, to Macinaggio, near Cape Corso, where immediately upon his arrival, at 6 P.M., he made such dispositions as seemed to him most desirable for barring the passage of his adversary. The Dupetit-Thouars with four torpedo boats was sent to the westward to watch and harass the squadron, and report its movements to the admiral.

On the 2nd June, towards 5 P.M., Admiral Lafont got under way and steered to the S.E. At the time of starting no vessel of the enemy

French Squadrons. Operations off Corsica.

was in sight, but towards 7 o'clock the Dupetit-Thouars and four torpedo boats were sighted.

At nightfall, when some thirty miles off shore, the admiral changed course to the southward. The Dupetit-Thouars and its convoy were lost sight of, but reappeared from time to time. With the idea of drawing this force away from its main body, Admiral Lafont continued on a south-westerly course until opposite the Gulf of St. Florent (Fig. I.), when at 10 A.M. of the 3rd he came about and directed the Duperré to give chase to the Dupetit-Thouars, then some 5 or 6 miles distant. The Duperré gained upon her about half a mile an hour, so that at 6 o'clock she opened fire with her barbette guns at 2200 metres range, and continued this until within 1200 metres, when she sheered to port, delivered the fire of her starboard broadside, and hauled off; for at this moment Admiral Brown, who had left Macinaggio, came out from Cape Corso with the Desaix, Aréthuse, and a number of torpedo boats to the relief of the Dupetit-Thouars. The Duperré declined further action with these except by opening on the boats (which remained at some distance) with her secondary battery, and steamed off to the northward, thus somewhat distracting attention from the main body.

According to the rules, the Dupetit-Thouars was *hors de combat.*

The Hirondelle at this time was cruising near Giraglia (a small island off the northern end of Corsica), and the Milan near the Gulf of St. Florent—to observe the enemy and to attract the attention of his torpedo boats. Having in a measure succeeded in this, they rounded the cape at full speed and proceeded to rejoin the squadron at the rendezvous agreed upon.

In the meanwhile the squadron of armoured vessels had steamed to the north-east, and when to the north of Cape Corso, and about 15 miles from Giraglia, the admiral steered to the southward and eastward at 10 knots speed, with the Couleuvrine and torpedo boats 71 and 74 thrown forward as scouts. At 3.30 A.M. of the 4th the passage of Cape Corso had been accomplished without sighting the Fulminant or either of the cruisers. Only four of the enemy's torpedo boats were seen; one by the Colbert and Friedland, the other by the scouts.

In the encounter with these it seems, from the evidence, that the torpedo boats could not have succeeded in effectively discharging their torpedoes under the fire of the ships.

The squadron continued its course to the south-east, through the Piombino Channel, and through the Straits of Bonifacio at 8 A.M. of the 5th, without encountering any of the enemy's force.

French Squadrons. Operations off Corsica. Fig. II.

The first period of hostilities expired on the morning of the 5th.

On the 6th, Admiral Lafont moored his squadron in the harbour of Ajaccio, without losing any of his vessels during the passage from the Gulf Jouan. It will have been noticed that the admiral had made more than one feint with his main force and scouts to deceive his opponent and draw off his forces. In this he appears to have been successful, for the passage of the cape was finally made with but little opposition.

If the squadron, upon the close of this period of operations after circumnavigating the island of Corsica, reached the port of Ajaccio intact, the division of torpedo boats had not been so fortunate. While crossing the bow of the Desaix at full speed on the evening of the 3rd, No. 66 collided with No. 64, the buffer spar of the former piercing the hull of the latter, whose injured compartment quickly filled with water. The boat, however, thanks to its pumps and water-tight bulkheads, reached the shore, about three miles distant when she sank in two fathoms of water. The Aréthuse remained near the wreck, and on the arrival of two wrecking tugs from Toulon the boat was raised. This and other lesser incidents somewhat hampered the operations of the torpedo division, and made the passage of the squadron more easy.

The squadron made the passage of the cape at night in safety, and had it attempted it by daylight, which at this season lasts 18 hours, the chances would have been the more in its favour; for a day attack from torpedo boats upon such a squadron must be comparatively hopeless. The result of the operations under the first theme for the second series must then be regarded as being against the chances of a flotilla of torpedo boats and supports preventing the passage of a strait by a squadron of armoured vessels.

Upon their arrival at Ajaccio the vessels of the squadron coaled and made preparations to lay the boom and obstructions for the defence of the port, which were to be made during the three days' truce intervening between the periods of hostilities (from the morning of the 6th until 4 P.M. of the 9th). The squadron was moored in three lines, the vessels heading to seaward, as indicated in Fig. 3.

Second theme.—A squadron of armoured vessels having taken refuge in an open roadstead upon the enemy's coast to repair damages or to give rest to its men, takes measures to protect itself against an attack of torpedo boats.

While the accompanying plate illustrates the principal features of the port of Ajaccio, the position of the vessels of the squadron, and

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Fig. 1.

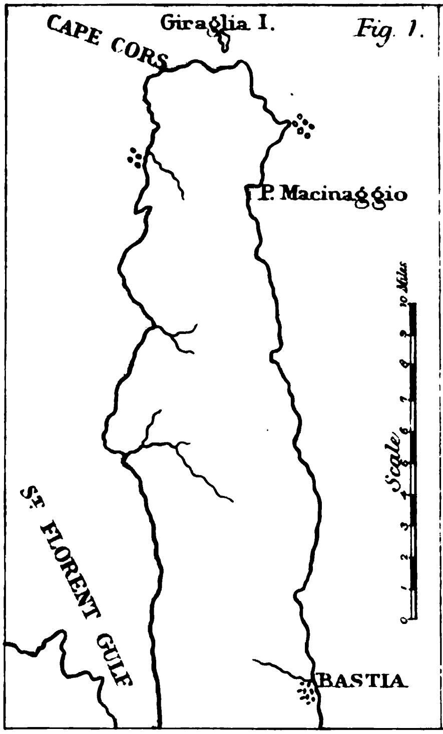


Fig. 2.

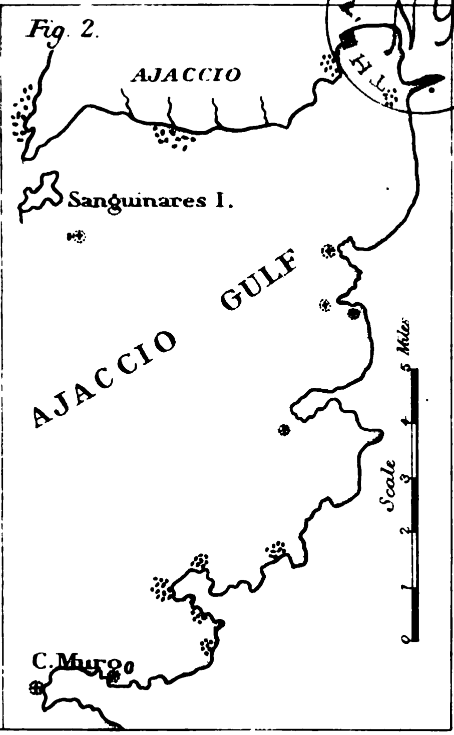
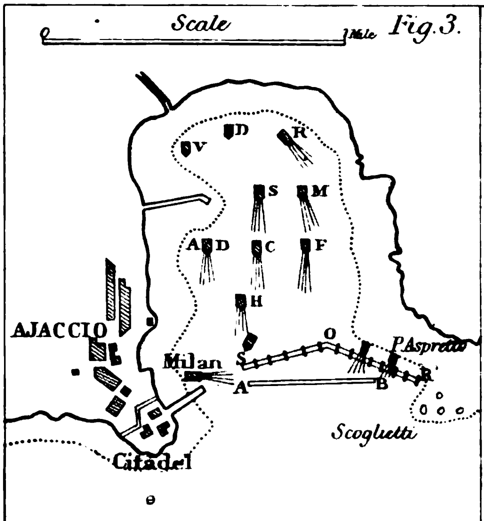
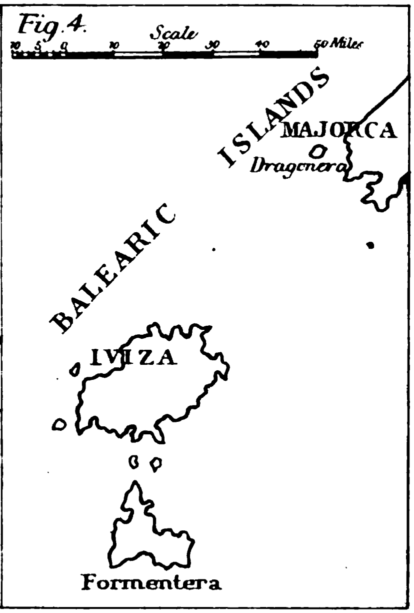


Fig. 3.



S.O.R. *Main obstruction.*
A.B. *Line of clothes-lines.*
Note. Ships are distinguished by the initials of their names.

Fig. 4.



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French Squadrons. Operations off Corsica.

the arrangement of booms and defences, a further description of the adjacent coast may be desirable.

The Gulf of Ajaccio, one of the many bights on the west coast of the island of Corsica, presents a width of entrance of over nine miles from the Sanguinaires Islands to Cape Muro (Fig. 2), while its depth is about eight miles, measured from the Sanguinaires Islands to the anchorage off Ajaccio. Merchant vessels anchor, or moor, behind the mole at Ajaccio; large war vessels, at the head of the bay, where the water is deep to the shore.

From the end of the mole to the Scoglietti, the rocks off Pt. Aspretto, the distance is about 1600 yards.

There is a narrow passage between these rocks and the mainland, through which 7 feet of water, sufficient for torpedo boats, can be carried; but this requires a smooth sea and an accurate knowledge of the locality. The passage is impossible at night.

On the morning of the 9th, the squadron placed the obstructions to bar the entrance of torpedo boats. From the Scoglietti to within 400 metres of the mole a double hawser was stretched, supported at short intervals by ships' boats. In advance of this obstruction a line of clothes-lines was placed so that the propellers of torpedo boats might become fouled before reaching the main obstruction. In rear, and near the flanks, were stationed steam launches armed with Hotchkiss guns. No mines were placed.

Such an obstruction would naturally be of little avail against an attack by heavy vessels, but by the conditions of the theme such vessels of the Brown division were restricted in their action to supporting and protecting the torpedo boats, and the obstructions were made with this in view.

The passage, 400 metres wide, betwee the mole and the obstruction, was left open for the passage of he merchant vessels trading with the port.

At 3 P.M. of the 9th, Admiral Lafont made signal for the ships to get out their torpedo nets. Those vessels which were not provided with the regular Bullivant nets protected themselves with canvas, awning-curtains, tarpaulins, &c.; actual experiment having before shown that these improvisations were comparatively effective against torpedoes. At 4 o'clock the nets were in place. Their distance from the ships' sides varied from 6 to 9 metres.

The new period of hostilities began at 4 o'clock, and at that hour the lookouts and scouts were stationed. At night a scout, a torpedo boat, and a steam launch patrolled the harbour and immediate

French Squadrons. Operations off Corsica.

neighbourhood. The latter was relieved at 11.30, but the others continued their duty until sunrise.

During the first and third night the Couleuvrine patrolled in the offing, and the Hirondelle took her place during the second night. Twenty-four hours was the duration of this patrol duty, which, during the daytime, was extended beyond the gulf and into the offing. At night the electric lights of the different vessels were directed, as indicated in the plate, so as to sweep all parts of the harbour and its approaches.

The ships' companies were divided into three watches, and there were two officers on deck at all times.

Let us now turn our attention to the torpedo boat division. Bad weather increased the difficulty of raising the sunken torpedo boat until the 7th. Wind and rain continued during the 8th, 9th, and 10th, delaying the departure of the torpedo boats and causing loss of time in which to attack. Finally, on the morning of the 11th, Admiral Brown, on board the Desaix, got under way from Macinaggio (Fig. 1) with the Fulminant and twelve boats, six of each class. The wind was still blowing strong, and the sea was running high; but the admiral wished to test the boats in bad weather. Two hours after starting it was found that the second-class boats (89 feet) were making such bad weather that signal was made for them to return to the anchorage. The Desaix was also labouring considerably, and her speed was reduced from 10 to 5 knots; but the first-class boats (108 feet) behaved well, and all reached Ajaccio in good condition. The Dupetit-Thouars had preceded Admiral Brown by one day, to reconnoitre.

Towards 4 o'clock in the afternoon the Admiral Brown's division was sighted by the Couleuvrine and reported to the squadron, which was now the more on the alert, not only from being aware of the arrival of the enemy, but from the fact that only one night remained in which the attack could be made. (Hostilities were to end on the 12th at 4 P.M.)

Admiral Brown, having been joined by the Dupetit-Thouars, anchored behind the Sanguinaires about 6 P.M., and received the reports of officers as to the disposition of the squadron and its defence. His force available for attack had been reduced from twenty to six torpedo boats, and he had lost the services of the Aréthuse (still remaining near the sunken torpedo boat), and, to add to his embarrassment, the weather was now clearing and the moon shining bright. As the moon did not set until after midnight, the time of attack was necessarily restricted to the short interval between that hour and 3 A.M., at which time the day broke.

French Squadrons. Operations off Corsica.

The weather at midnight was clear and calm, with occasional light airs.

At 12.40 the Couleuvrine signalled that the enemy was under way, and immediately the electric lights of the squadron lit the harbour.

At 1.5 the approach of the enemy was signalled.

At 1.45 a torpedo boat made an attack upon the Hirondelle, but received the fire of the Hotchkiss guns of the squadron, and would doubtless have been disabled or destroyed before firing a torpedo effectively.

At 2.5 the Fulminant (now flagship) was discovered in the direction of the Scoglietti accompanied by the torpedo boats. Under the electric lights her form, turret, and other details were readily distinguished. She steamed close up to the boom and sent forward two boats with the intention of grappling the obstruction, which, when grappled, was to be bodily towed or torn away by the ship. The boats, however, were constantly under the squadron's fire, and could hardly have accomplished their purpose.

At this time the torpedo boats made the principal attack. Four attacked by the passage left open, the fifth became entangled in the obstruction, while the sixth received some slight damage to her machinery and was not ready at the time of the attack.

Three of the first mentioned boats attacked at moderate speed, in full sight under the search lights, and were constantly under fire. The evidence seems sufficient to show they were unsuccessful, and that in cases where the torpedoes were signalled by the boats as having been successfully discharged (by burning a blue light) the range had been much under estimated. The fourth boat, under the command of Lieutenant Duboc, of Sheipoo fame, took advantage of the Hirondelle's search light being directed to the southward of the mole to attack, at 2.20, at full speed, under cover of its shadow. His attack was probably successful, as the Hirondelle fired but three shots at him before his torpedo was discharged, when he steamed into the offing.

At 2.25 the Fulminant withdrew, and the attack was over.

At 2.50 the search lights were extinguished, and day began to break.

While there still remained twelve hours during which hostilities were to last, any day attack would have been hopeless. The second period of operations was therefore closed.

French Squadrons. Operations off Corsica.

The electric search lights are reported to have served with twofold effect; they not only effectually lighted the harbour and entrance, but their intense light blinded the approaching enemy, and rendered all estimate of distance extremely difficult. It was again shown that search lights should be carried as low as practicable in order to secure their greatest efficiency.

The attack was a failure, and it must be admitted that the chances were against the torpedo division. The weather had been extremely bad, the number of boats reduced to six, and on the only night on which the attack could be made there was a bright moon until midnight. These, however, are the chances which the torpedo boats must expect, and must take. But, on the other hand, in actual war, there might have been the chance of destroying the obstructions by ramming them with the supporting ships, which would have opened the way for the boats and made their task somewhat easier.

On the 15th the squadron, re-enforced by the Richelieu, sailed for Oran, Algeria; and on the 16th Admiral Brown's division returned to Toulon, preparatory to carrying out the third and last series of operations.

THIRD PERIOD.

Passage of the Balearcs.

The forces taking part in the operations of the third period were the same as before, except that Admiral Brown's division contained but thirteen torpedo boats, all of the first class (108 feet); the second-class boats being considered unsuited for operations on the high sea. Admiral Lafont's squadron was at Oran, and Admiral Brown's division at Toulon, where the period of operations began on the 25th of June.

The theme was as follows:

Theme.—A squadron coming from Gibraltar to attack Toulon or Marseilles is obliged to pass through the Balearic Islands, within a belt comprised within two parallel lines 28 miles apart, so drawn as to pass between Iviça and Majorca, and touching the island of Dragonera (see Fig. 4); when within 15 miles of the French coast the squadron will be considered as free from attack. A division of torpedo boats will endeavour to attack the squadron while *en route*, and prevent its passage.

Naturally, the torpedo-boat division took station to the southward of the Balearic Islands, near the prescribed pass, in order to make sure of intercepting the squadron.

On the 25th, at 1 P.M., the squadron got under way from Mers-el-

Kebir (Oran), and stood to the N.E., in echelon of vessels. The speed was set at 6·2 knots. The Couleuvrine and the two torpedo boats, 71 and 74, were taken in tow by the armoured vessels.

French Squadrons. Passage of the Balearcs.

On the 27th, in the early morning, the Aréthuse was sighted, with upper masts housed. At 6.30 A.M. she was still in sight to the N.W., distant about 16 miles, and evidently watching the squadron. At this hour the squadron changed course to the S.W., and housed its upper masts. At 10.45 Admiral Lafont made signal to start fires in all the boilers.

At noon the position of the squadron was latitude 37° 15′ north, longitude 1° 06′ east, about 90 miles from Formentera. The torpedo boats were cast off and coaled.

At 1 P.M. the squadron steered N.N.E., and the speed was set at 10·5 knots.

Notwithstanding that the sea was calm, the sky overcast, and the squadron sighted by one of the enemy's cruisers, Admiral Lafont decided to attempt the passage that night.

Admiral Brown's division was in the neighbourhood of Dragonera on the afternoon of the 27th, and at nightfall it steamed to the southward, at about 8 knots speed, in four groups. On the left of the line was the Aréthuse with three torpedo boats, in the centre the Dupetit-Thouars and Desaix, each with three boats, while on the right was the Fulminant with the remaining torpedo boats. The plan of watching, or patroling, adopted by Admiral Brown, was to steam in line to the southward at night, and in the daytime to retrace his steps to Dragonera, so as to insure discovering and attacking the squadron at night.

At 9 P.M. the squadron took in its running lights and steered North upon making the Formentera light. At midnight the lights of the Aréthuse and torpedo boats were sighted.

At 1 o'clock the engagement took place, between Iviça and Majorca. No. 72 attacked the Redoutable, and though fired upon by that vessel and the Suffren, it succeeded in getting within effective range, when it burned its blue light. Another of this group, No. 27, is said to have discharged one torpedo at a passing merchant steamer, and a second torpedo at its convoy ship, the Aréthuse. The Dupetit-Thouars and group did not sight the squadron until the search light of the Colbert was turned on the passing merchant steamer; then the cruiser gave the alarm, but its boats did not succeed in attacking.

Admiral Lafont sent back his torpedo boats for the protection of the rear ships, and increased the speed to 11·5 knots.

French Squadrons. Passage of the Baleares.

The torpedo boats of Admiral Brown's division gave chase, but at daylight they were not in sight.

The squadron steered for the Planier light, and at 12.30 A.M. of the 29th sighted it. At 3 A.M. the 15-mile limit (from the coast) was reached;* the squadron was free from further attack, and at 8 A.M. moored in Toulon harbour. It was delayed off the Planier by an accident to the machinery of the Richelieu, which vessel had been in commission only a fortnight.

Admiral Brown, after the passage of the squadron, had gathered his division together by 10 A.M. of the 28th. The Dupetit-Thouars and group reached Toulon at 9 A.M. of the 29th, but the other groups did not arrive until 3 P.M.

The results of the attack of the torpedo boats upon the squadron seem to have been as follows: The Redoutable struck by a torpedo; the Aréthuse struck by a torpedo from one of its own boats; a passing merchant steamer fired upon by a torpedo boat; and, as claimed by the torpedo boats, the Richelieu struck by a torpedo, although there is little evidence to support this.

A notable fact is brought to light by this period of the operations, viz., that the torpedo boats which on trial made 20 knots could not overtake a squadron making 11·5 knots. This was due to the fact that the boilers of the torpedo boats had become so dirty during their four-days' cruise as to make it impossible to get the required steam.

CONCLUSIONS.

General conclusions.

Off Toulon (1st period) the torpedo boats were unable to drive off the squadron of armoured vessels or to seriously interfere with the bombardment of the town (supposed to be without other defences than the torpedo division), the squadron having attacked by day in a sea which did not seriously disturb the accuracy of its fire, but rendered the discharge of torpedoes from the torpedo boats difficult, if not impossible.

Off Toulon the torpedo division was unable to break the blockade of the port, although it was claimed that the Desaix escaped. Torpedo boats must naturally increase the anxiety of a blockading squadron; but the nets with which armoured vessels now surround themselves under such circumstances greatly reduce the chances of torpedoes

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* The distance from Formentera to this limit is about 300 miles. The distance run from 2 A.M. of the 28th to 8 A.M. 29th was about 290 miles (knots).

French Squadrons.

reaching them. Blockading squadrons must always be accompanied by swift cruisers and counter torpedo boats to increase the chances of discovering and beating off attacking boats before getting within range of the heavier vessels.

For open-sea work the 89-foot boat proved altogether unsuitable, as shown in the second period of operations between Toulon and Ajaccio, and the chances of an effective force of 108-foot torpedo boats reaching a remote destination in condition for prompt attack cannot be very great, unless undertaken during the fine seasons of the year.

The chances of a successful attack by a small number of torpedo boats upon a squadron protected by booms, if well equipped and on the alert (as at Ajaccio), must be very small. And again, in operations similar to those of the third period, the advantage should be with the heavy vessels, if properly handled and informed of the enemy by scouts and look-outs. Doubtless in such a passage a squadron will suffer some loss; but it should be accompanied by its own torpedo vessels, which will deal with the enemy's torpedo boats at a distance and reduce their chances of succeeding in their attack.

All parties in France, the torpedoists as well as the conservatives, are agreed that the French torpedo boats in service a year ago were altogether too small and too frail for work at sea. The reduction of their speed in a sea-way, probably from 18 or 20 knots to 12 or 13, detracts seriously from their value. The new torpedo boats now building, or completing, vary in length from 115 to 151 feet, and in displacement from 53 to 148 tons.

There are also the 111-foot boats, numbered from 75 to 104. The English learned this lesson a year earlier, and their newer boats are 125 feet long and 60 tons displacement.

A special class of men must be trained for service in torpedo boats, for, with increased experience in the crew, the increased efficiency of the boat is very marked. The outward voyages of the torpedo boats from the Atlantic varied in duration from twenty to twenty-five days; while in returning from Toulon, Nos. 60 and 67 made the voyage to Cherbourg in eleven days and six hours, stopping 26 hours in Cadiz and 20 hours at Corunna; No. 29 made the voyage to L'Orient in nine days and three hours, stopping at Gibraltar, Lisbon, and Corunna; No. 71 made the voyage to Cherbourg in nine and one-half days. Of course the difference of season must be considered in making the comparison between the outward and homeward voyages; but this cannot account altogether for the reduction of duration of the voyages by more than one-half.

Admirals Lafont and Brown were called before the Budget Committee of the French Parliament after the manœuvres. They are reported to have testified as follows: That the torpedo boats used were too small; the position of their tubes should be altered from their present place in the stem to a higher position somewhat removed from the bow. It was frequently found that in a sea-way it would have been impossible to open the torpedo-tubes without danger to the boat, or at least without seriously impairing all accuracy of discharge, or even to get the torpedo into place in the tube. It is said that these officers recommended the construction of armoured vessels of from 6000 to 8000 tons displacement, and that they insisted upon maintaining a squadron of evolutions and instruction composed of vessels carefully chosen for the purpose.

A study of the manœuvres from beginning to end impresses the reader with an idea of the excellent organization of the French navy, the skill and training of its personnel, and the system, or programme, by which new vessels are built, so that when complete the fleet will be homogeneous, capable of united action, and equipped with all classes of vessels necessary for the performance of the various duties imposed upon it. The maximum speed of the armoured vessels, given in the tables, is remarkably uniform, and enables a fleet to maintain a fair rate of speed. The squadron of nine armoured vessels (several of them old), and two cruisers, with torpedo vessels and boats, steamed in a prescribed order for more than twenty-four hours at a speed of 11·5 knots. It is thought that no other nation could, at that time, have assembled a squadron of armoured vessels of the same number which could have steamed in squadron at that speed for that length of time. Speed has but recently become the great desideratum, and the new armoured vessels now coming forward will make the movements of squadrons much more rapid; but in organization, construction, training and drill, painstaking in details, experiment, and the maintenance of a formidable squadron of evolutions in which to teach the art of war, the French Navy is unsurpassed and commands the respect and attention of the naval student.

FRENCH NAVAL MANŒUVRES, 1887.

French Naval Manœuvres, 1887. Passage from Toulon to Algiers.

The following is a translation of the narrative of M. Weyl with his remarks on the proceedings:—"The management of a convoy is one of the most difficult of naval operations. In the present day, not less than in the period of sailing ships, the highest skill will be required on the part of the officer in command. Skill is required to keep armed ships in such positions as to afford at all times protection to the transports, while the energy and determined character of the commander will be shown in a firm resolve to achieve the main object of the operations. He must be prepared to sacrifice in case of need all the fighting vessels, in order to secure the safety of the convoy. It may be laid down as a general rule that with steam so many means of attack may be practicable, that no ships should be employed for the transport of troops in time of war which do not possess high qualities of speed. It would be difficult to intercept vessels of high speed taking a happy opportunity for making a short passage.

"Let us suppose that the object were to reinforce the garrisons in Algeria, or to transfer to France a portion of the 19th corps d'armée; an operation of this nature would be facilitated by the great length of the southern coast line of France, the long extent of shore embraced in our African possessions, the facilities of concentration by means of railways, and the numerous points on which a landing can be effected on both shores of the Mediterranean. The passage could generally be accomplished without very great difficulty, provided that only swift steamers be employed. With these observations we will endeavour to draw from the operations which the squadron has just carried out, and which the torpedo division could not prevent, such useful instruction as it is possible to gather from a plan of operations, not well thought out, and which is open to much criticism. We proceed to state the conditions which were laid down, and to point out the anomalies."

"Four ironclads, insufficiently supported by look-out ships, receive orders to convoy from Toulon to Algiers four transports, full of soldiers. A division of torpedo boats operating from the shores of Corsica or Sardinia, is to endeavour to deny the passage to the convoy. The forces of the two belligerents consist of the following ships:—

"Escorting Division—Colbert (Vice-Admiral Peyron), Amiral

Duperré, Courbet, and Indomptable; Four ironclads representing transports, Dévastation, Redoutable, Trident, and Richelieu; Look-out vessels, Milan, Hirondelle, Condor; Torpedo boats, first class, Balny and Déroulède.

"Experimental Division — Desaix (Rear-Admiral Brown de Colstom), Villars, Seignelay, Dupetit Thouars, Annamite, sea going torpedo boat Doudart de Lagrée, and 17 first-class torpedo boats.

"Under the rules laid down, the convoy was not to exceed a speed of ten knots, though the look-outs might steam at full speed. According to another of the rules prescribed, whatever might be the state of the sea, every torpedo boat within range was supposed to be able to fire a torpedo. This was to assume the solution of a problem which is very far from having been mastered.

"The tactics of the squadron were of a very simple kind. The alternatives were to wear out the torpedo boats by steering in various directions, thus obliging them to keep the sea for several days, or to take advantage of bad weather to make the passage. The latter was the plan adopted.

"On the 14th of May, in the morning, Admiral Peyron proceeded to sea. A strong mistral was blowing. At the same time he informs Admiral Brown that he is leaving port. The latter had been since the previous Tuesday at Ajaccio, where his boats were allowed a few days' rest. A heavy sea was running, but on receiving the warning despatch from Admiral Peyron, the commander of the experimental squadron sends out in advance the Dupetit Thouars and the Doudart de Lagrée. Later the Admiral made an attempt to follow his look-out ships with the torpedo flotilla under his command. It was found impossible to keep the sea, and the flotilla was compelled to return to its anchorage at Ajaccio. During the short period they were at sea, the Doudart de Lagrée, and the gunboat Gabriel Charmes sustained severe injuries.

"The squadron made the passage without meeting the enemy, and anchored at Algiers 29 hours after its departure from Toulon. The north-west wind had blown with violence for some hours after the squadron left the French coast; but as the convoy was steaming before the wind, the sea was not felt. If the torpedo boats had endeavoured to make for Algiers, they would have suffered as much from the weather as from their position to the eastward. They would have had the sea on the beam.

"Admiral Brown exercised a wise discretion in not calling upon his crews to make useless struggles, and waiting until the storm had passed away before putting to sea. On the Monday at two o'clock, that is to say 24 hours after the arrival of the squadron at Algiers, the torpedo boat division weighed, and steered for the Balearic Islands, where they arrived on the following day.

Behaviour of Indomptable in a seaway.

"In connection with the passage of the ironclad squadron an incident took place worth mentioning. As we have said, stormy weather was experienced outside Cape Sicié. The sea was very heavy, and the Indomptable, which was leading the second line, was entirely covered with water. The ship made a signal that her battery was flooded, and that she had some difficulty in keeping her station. The Admiral accordingly gave permission to fall out of line, and the vessel steered for Hyères, leaving again on the 16th to join the flag of the Admiral at Algiers.

Balny and Déroulède.

"The other ships behaved well. The Balny and Déroulède kept under the lee and at a short distance from the ironclads, which sheltered them as much as possible from the sea. They did not delay the passage of the squadron. It must, however, be remarked that one of these torpedo boats caused a momentary anxiety. She rolled so heavily, and was so long in righting herself that it was feared she must capsize. Happily she righted, to the great relief of those who were looking on from the decks of the large ships. The type Balny or Déroulède, a torpedo boat of 125 ft. in length, is much superior to the 100-ft. boats. It is, according to the opinion of the officers, the smallest type which is capable of keeping company with the large ships.

Admiral Lafont steers for Dellys.

"As the squadrons made Southing the wind fell, and the sea became smoother; assuming it to be possible that bad weather had not reached the Corsican coast, and that the division of torpédo boats was at sea, Admiral Peyron ordered a good look-out to be kept on board the ships, and steered for Dellys, to the east of Algiers, regulating his speed so as to make the land about four o'clock in the morning. In the event of his adversary having reached Algiers and taken up a position, with the view of preventing him from entering the port, the Admiral made a judicious movement in steering to the eastward and closing the land. At this season, at dawn, the Algiers coast is always covered with mist; under the high land at Dellys, the squadron, shrouded in the mist would not be seen by the look-outs in the torpedo boats, more especially as they would be blinded by the rays of the rising sun.

General conclusions.

"By leaving when it did, the squadron had every chance of defeating the adversary, who was sure to be paralysed by bad weather. The formation of the squadron, when under way, and the landfall were good tactics worthy of imitation. One last reflection. In the actual practise of war the transport of troops would never be carried out in ships steaming only 10 knots. If the State had not the number of ships of the speed necessary for the operation, it would make use of the steamers of the postal service in the Mediterranean, or better, those of the line to New York. Of the former ships, several steam on their regular passages 15 knots. The latter, with their 17 knots speed, would cross the Mediterranean in twenty hours. It is, therefore, a departure from what would actually take place to impose the conditions laid down, with the view of fettering the action of the convoying squadron. The look-out duties for a squadron consisting of four ironclads and four transports full of troops ought to be entrusted to a much larger number of vessels than were available under the flag of Admiral Peyron. If it is desired to do something useful we ought to give up the fictitious system adopted in our manœuvres, and to imitate the proceedings of our neighbours on the other side of the Channel, who are studying in a reasonable way the tactics and the method of employing torpedo boats. Some definite results will be gained by the work upon which they are engaged. No new lessons will be gathered from our operations."

Abandonment of cruise from Toulon to Brest.

M. Weyl contributed another article to *Le Yacht* of the 11th of June, 1887:—"The Minister is reported to have given the order to break up the experimental squadron, and to put an end to the preparations which were being made at Toulon to carry out the second operations of the great manœuvres.

"In the general order transmitted by Admiral Aube on the 7th of March, 1887, to the Commanders-in-Chief of the two groups of vessels representing hostile forces, the following scheme of operations was promulgated: The squadron will leave Toulon for Brest. It will be followed by a flotilla of torpedo boats representing a hostile flotilla. In the instructions issued by the Minister it was ordered that for the purposes of these operations the squadron should be composed of six ironclads, fully manned, viz. Colbert, Dévastation, Courbet, Amiral Duperré, Redoutable, Indomptable, and the cruisers Sfax, Milan, Hirondelle and Condor. The torpedo boat division was to be constituted as for the first series of manœuvres. It is obvious that the two serious failures of the experimental squadron during the month of May had made an impression. The cruise in the ocean was to terminate at Cadiz instead of Brest, and certainly it was not for the convenience of the ironclads that this determination was proposed to be taken. It was accepted that it was impracticable to make the passage in torpedo boats from Toulon to Brest.

Torpedo boats cannot keep the sea.

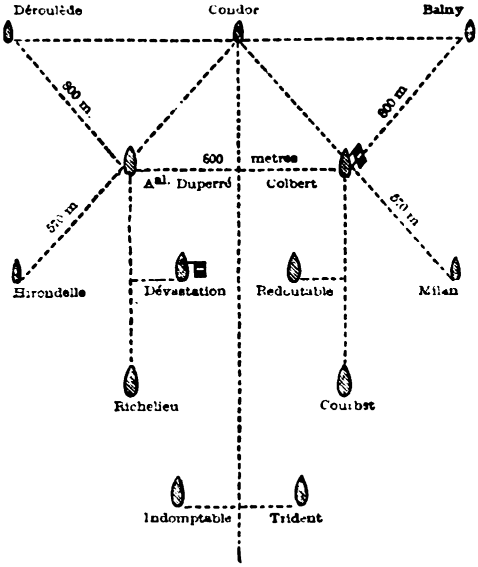
Actual trial had demonstrated that these little boats are incapable of keeping the seas more than 48 hours, and then only in moderate weather. According to the admission of the officers of Admiral Brown's division, it was to this impossibility of making the sea passage that we are to attribute the complete failure to attack the squadron and its convoy between Algiers and Toulon. It is known that the torpedo boats were watching the departure of the ironclads from Algiers, that a group led by the Villars had followed them to the eastward during the whole day of the 23rd, and that at night the cruiser was about nine miles distant from the fleet, under Admiral Peyron. The latter, therefore, expected to be attacked in a few hours.

"Why, therefore, did not Admiral Brown make his attack? This is the explanation. The Commander-in-Chief of the experimental division was exceedingly anxious for the safety of the boats. He said to himself that it was all very well to make experiments, but that he was not justified in risking the sacrifice of a flotilla of so much value as that which had been committed to his charge. Several of his torpedo boats were injured. It might be possible, if he ventured as far as the coast of Algiers, that he would bring back to Toulon only a few survivors of this flotilla. He had other sources of anxiety. The torpedo boats Number 99 and 100, both being one hundred-feet boats, which had joined the Admiral at Ajaccio, had been thrown on their beam ends, and for several minutes their crews gave themselves up for lost. The boats had righted, but what confidence could he have after such anxious experiences? All these reasons carefully weighed had discouraged the Admiral from placing himself before Algiers, as he might otherwise have done, with the view of denying the harbour to his adversary, and forcing him to battle. It was against tactics of this kind that Admiral Peyron had taken his precautions, and all his arrangements were calculated with a view to repulse the torpedo boats equally by day and by night. The Admiral and officers of the armoured squadron did not conceal the regret they experienced at the complete failure of the manœuvres. So much money having been spent, such attention having been given to the preliminary arrangements, it would have been interesting to have had one engagement, and it is much to be regretted that it could not take place.

"The squadron remained at Algiers until the 23rd—that is to say for a full week, a period of time which was considered necessary to bring together the military forces which were to be conveyed to France. On the same day the torpedo boat division anchored in the Balearic Islands was to go in pursuit of the squadron, with the view of disputing the passage.

Formation of convoy.

"The formation adopted by the Vice-Admiral commanding the Squadron of Evolutions deserves attention. The ironclads were divided into two groups. The fighting ships were Colbert, Richelieu, Amiral Duperré and Courbet. The Dévastation Redoutable, Trident and Indomptable were to represent the transports. To protect the convoy, the Admiral had only five look-out ships and torpedo boat-catchers, the Hirondelle, Milan, Condor, Balny, and Déroulède. The ships were in the formation shown in the diagram.



"The Admiral had not sufficient ships to cover his rear. The two look-out ships, Hirondelle and Milan, kept watch on either beam, abreast of the Dévastation. The squadron, including the convoy, covered a space of 2000 metres in length, and 1600 metres in width. The formation offered great advantages, and was an admirable solution of the problem which had been proposed. It was, in point of fact, the order in column of divisions, the right division indenting to port, and the left-hand division to starboard. Each battle-ship had thus a transport for his next astern. The four transports were, therefore, protected by four ironclads, which only required for their protection an additional force of five torpedo boat-catchers. It is proper to add that the manœuvres proved that a vessel under weigh with a certain speed has little to fear from the attacks of torpedo boats coming up astern. In the formation adopted it was possible to navigate without risk, the two leading ships carrying their mast-head lights on a dark night; the others their stern lights.

In case of attack the ironclads were allowed to make use of their upper deck armament, of less calibre than six inches, their Hotchkiss guns, and their small arms. Every torpedo boat was considered to have been put *hors de combat*, if during a night attack it received 50 shots from the Hotchkiss guns at a less distance than a thousand metres; if by day or by night it received the fire of a single gun carefully laid for elevation and direction at a distance of less than 500 metres.

"All these conventional arrangements were well considered. Nothing, in point of fact, was wanting except the possibility of putting them in practice. The operations themselves were badly planned."

OPERATIONS ON THE COAST OF CHINA UNDER ADMIRAL COURBET, 1884.—BOMBARDMENT OF FOOCHOW, AUGUST 23, 1884.

[Translated from the volume published by Maurice Loir, Lieutenant on board the Triomphante.]

[This interesting narrative was not ready for publication when the first number of *The Naval Annual* was in the hands of the printers.—B.]

Chinese force. The Chinese naval force engaged included eleven ships. Their largest vessel had a displacement of 1600 tons. Two gunboats were of the Alpha-Beta type, 325 tons, and armed with one 27-ton gun. The combined crews numbered 1220 men. In addition to these eleven vessels the Chinese flotilla comprised eleven war junks and seven steam launches fitted with spar torpedoes.

French squadron. The French squadron included the Volta, Aspic, Lynx, Vipère, Duguay-Trouin, Villars, D'Estaing and two torpedo boats. The armament consisted of 58 guns, of which five were 19-centimetre, or 7½-inch guns. The French squadron was well armed with quick-firing and machine guns. All the French ships went into action with their upper yards and masts sent down on deck.

Disposition of the French ships. Admiral Courbet had moored his ships off the Pagoda Peninsula. The apex of this triangular peninsula is to the south. The two sides of the triangle incline to the north-west and north-east respectively.

Facing the north-western side of the peninsula, on which the well-known arsenal of Foochow has been established, the Volta was anchored at the head of the line, the next ships astern being the Aspic, the Vipère, and the Lynx, with two torpedo boats. Surrounding these four ships the Chinese had distributed their war junks and their junks manned with soldiers. A little higher up the river were eight of their larger vessels. The torpedo launches were in a creek near the Custom House, on the opposite side of the river to the Pagoda. Below the Pagoda and to the north-east were the three cruisers Duguay-Trouin, Villars and D'Estaing, and abreast of them, near the Custom House, three Chinese sloops.

The River Min at this point has a breadth of less than 1100 yards. The two hostile squadrons were, therefore, a few hundred yards apart. The depth of water being insufficient, it was impossible for the three large French cruisers to approach the Volta except at high water.

Below and outside the lines respectively occupied by the hostile forces were the American corvette Enterprise, commanded by Admiral John Lee Davis, and the English corvettes Champion, Sapphire, and Vigilant, under the command of Vice-Admiral Dowell.

Plan of attack.

On Friday, the 22nd of August, at eight o'clock in the evening, the French Admiral called the captains on board the Volta, and communicated to them his plan for the engagement, which may be summed up as follows:—During the ebb tide of the afternoon of the 23rd of August, a little before two o'clock, the ships were to weigh. At a signal from the Admiral the two torpedo vessels were to attack two of the Chinese vessels at anchor above the flagship. On the second signal fire would be opened along the whole line. The Volta, while supporting the attack of the torpedo boats with her guns on the starboard side, would open fire on the port side on the war junks, to whose fire she would be chiefly exposed. At the same time the gunboats Lynx, Aspic and Vipère, leaving the Admiral's ship on the port hand, would proceed at full speed and engage the three gunboats and three sloops which were moored off the arsenal. The Duguay-Trouin, the Villars, and the D'Estaing were to sink the three Chinese sloops anchored on their beam, and with their other broadside were to enfilade the Chinese junks. The D'Estaing would enter the creek near the Custom House in pursuit of the torpedo boats, and would rejoin the Volta.

Attack on Chinese force.

On the 23rd, at half-past nine, the flood made, but as in many rivers, lasted only four hours. At a quarter to ten steam was up; at eleven the crews of the French ships dined. The weather was somewhat cloudy, and the heat was overpowering. At half-past one the men were mustered at their guns without sounding the bugle. The Chinese also went to quarters. At 1.45 anchors were weighed, and all was ready to open fire. The plan, as arranged on the previous day, was executed with the utmost precision. At the appointed signal the torpedo boat No. 46 weighed, steamed forward at full speed a distance of 700 yards, and exploded a torpedo against the Vango, amidships on the port side. The sloop though mortally injured was able to steam on to the mud, where she sunk. On board the torpedo boat the engines were reversed, but only a few revolutions had been made when the boiler was burst by a shell. No. 46, disabled, drifted down towards the neutral ships, near which she anchored. One man only was killed by a ball.

The torpedo boat Latour (No. 45), though handled with equal courage, was less successful. In steaming forward to attack the Fosing, she met a Chinese torpedo launch, and was unable to deliver her blow on the Fosing at the place intended. The explosion did not result in the immediate destruction of the enemy, and the torpedo-boat was for several moments unable to steam clear of the Chinese vessel. The Chinese crew, recovering from the terror caused by the first attack, poured a shower of balls and even shells thrown by hand upon the torpedo boat. A ball from a revolver struck M. Latour in the eye, and a shell broke the arm of one of his crew. After a few minutes of extreme peril, the Fosing succeeded in steaming ahead, and the torpedo boat was suddenly parted from her adversary. She steamed out of action and anchored near the American corvette Enterprise. At this moment M. de Lafeyare, second in command of the Volta, who was entrusted by the Admiral with the command of the flotilla of boats containing the boarding party, perceived that the attack of No. 45 had not completely succeeded, and he decided to deliver a second attack with a torpedo on the Chinese sloop. Embarking in a launch belonging to the Volta, armed with a spar torpedo, he pursued the Fosing, and succeeded in striking her in the vicinity of the screw. The propeller was injured. The ship stopped immediately, and in a helpless condition drifted down the stream, being repeatedly struck with shells fired from the French gunboats. She was promptly boarded, and the French colours hoisted.

Arrival of heavy ships of French squadron.

Suddenly in the distance heavy firing is heard below the Pagoda. It proceeded from the heavy guns of the Triomphante, to the commander of which (Baux) a discretion had been allowed to enter the river, if he thought it practicable, or found a pilot to take him up to the Pagoda. For twenty-four hours he had been engaged in lightening his ship, by sending a portion of her stores on board the Nieve. At 10 o'clock he had left Matson. His men were stationed at the guns ready to open fire, but he had been allowed to pass the Forts Kinfai and Mingan without a shot.

Volta in action.

Meantime the Volta had fired a few shells at the Yango, which had hastened the destruction of that vessel. The Admiral had pushed his ship into the thick of the action, close to the Chinese junks, from which a rapid fire was maintained. One of their shots passed across the bridge of the vessel, killing the pilot Thomas and two men at the wheel. The three gunboats, Aspic, Lynx, and Vipère, in passing the junks had fired into them two or three broadsides, and then proceeded to engage the ships higher up, inflicting upon them great injuries. They then proceeded to open fire on the Pagoda batteries and the sloops moored in the vicinity.

Close of the engagement.

The atmosphere was absolutely still. In a few seconds a thick smoke covered the ships, it became difficult to distinguish enemies from friends, and gradually the cannonade slackened. At 2.25, after the action had lasted thirty minutes, it ceased almost entirely on both sides. Shortly afterwards the smoke passed away, and it was not without anxiety that the condition of the fleets was scrutinized. The French ships were uninjured. The Chinese fleet had been destroyed; nine junks were sinking and burning at the same time, and their crews were in the water. The Yango was in flames. The two transports had been abandoned by their crews, one being subsequently burnt and the other blown up. The two small vessels alone had been enabled, owing to their light draught of water, to effect their escape. The two gunboats of the Alpha type were drifting down the stream, their crews having sustained frightful loss. The three sloops near the Custom House had met with a similar fate.

At 2.32 the firing recommenced, it being necessary to reply to the land batteries, which again opened fire on the fleet as soon as the smoke had somewhat cleared. At three o'clock all the Chinese vessels had been sunk. At four o'clock the Admiral made a signal to fire no longer except in self defence. The land batteries seeing our fire slacken regained confidence. The flagship attracted the heaviest fire, and it took nearly an hour to silence the Chinese guns. At 4.55 the order was given to anchor for the night out of range of the forts. In the evening the Admiral forwarded to the Government the following despatch:—

"A good beginning this day. Twenty-two Chinese junks and ships destroyed; five commanders, 39 officers, and 2000 soldiers and marines killed. Our loss, six killed, 27 injured. No serious injury."

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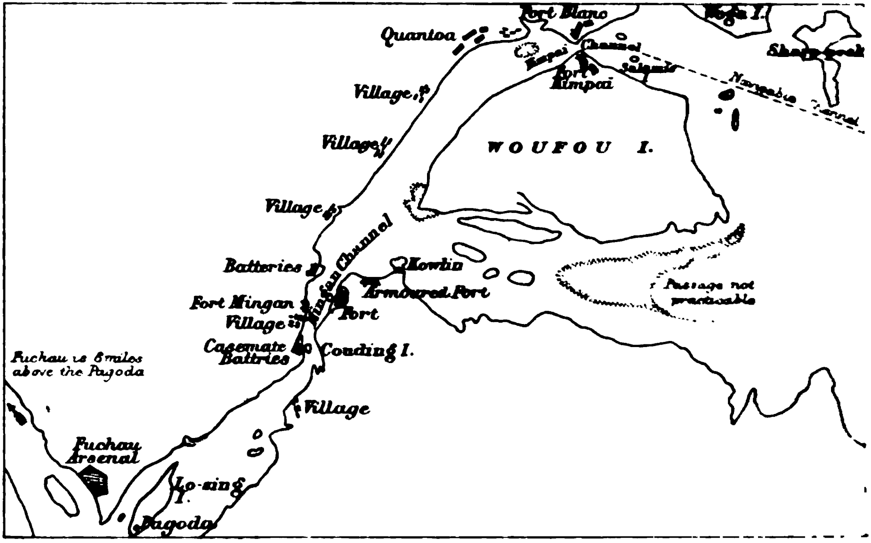
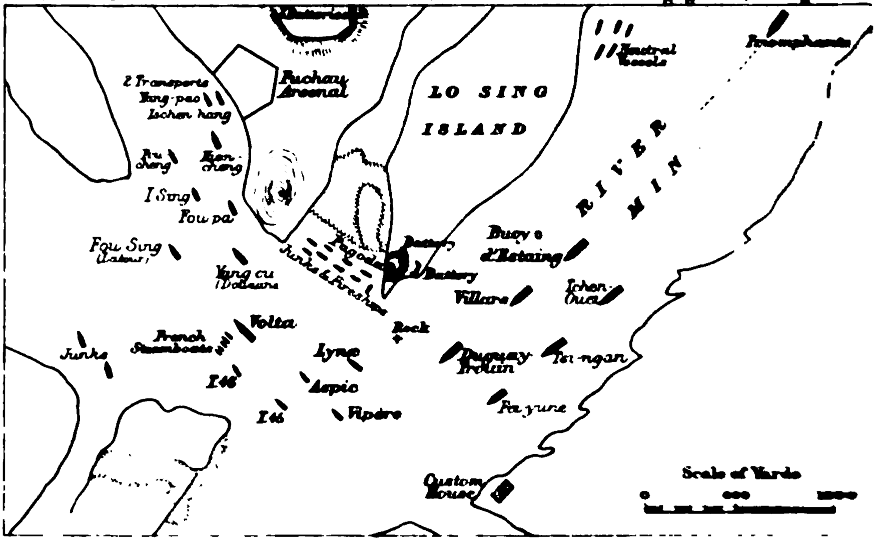
GENERAL CHART OF THE RIVER MIN.



Position of French & Chinese Vessels at the commencement of the engagement, 23 Aug. 1884



DESCENT OF THE RIVER MIN FROM THE 25TH TO THE 29TH OF AUGUST.

Descent of the River Min.

The first work with which the squadron had to deal was a casemated armoured battery on the left bank abreast of the Isle Conting armed with an 8-inch gun pointing down-stream. At two o'clock on the 25th of August the squadron anchored. The Triomphante and the Duguay-Trouin were 1000 metres S.E. of the island in a position from which they were able to attack the battery in rear. From five o'clock until 5.40 their 9½-inch guns maintained a heavy fire, which compelled the defenders of the battery to abandon it. The Admiral sent a landing party in torpedo boats to burst the guns with gun-cotton. The night was spent at the anchorage.

Operations of the 26th August.

On the 26th, at 11 in the morning, the squadron weighed, led by the Duguay-Trouin with the Triomphante as her next astern. These two ships were to destroy the batteries which line the river from Mingan to Kimpai. Their heavy guns alone were capable of producing any effect upon the strong defences of the enemy. The 5½-inch guns were useless against the strong works, and they formed the sole armament of the other ships. The latter were to protect the torpedo boats and the landing parties, and to fire on the Chinese infantry, who might be expected to appear at any moment on the heights commanding the river.

Almost all the defences, or at least the most modern and therefore the strongest, enfilade the river in the direction of its mouth. They were entirely constructed with a view of opposing the entrance of the squadron into the river. As in the present case the Admiral was going down the river, it was possible for him to take up positions from which he could attack the batteries in rear, and effect their complete destruction, without exposing his ships to the enemy's fire. Our only risk, therefore, would arise from the fire of the barbette batteries, and from the guns which, during the last few days, had been placed in position to fire up-stream, in anticipation of our descent of the river. These guns were few in number, and the barbette batteries were armed with Chinese guns of obsolete pattern.

It was by his skill in taking up his position in rear of the forts that the Admiral succeeded in passing the narrows of Mingan and Kimpai. In the narrows of Mingan there were placed on the right bank near the village of the same name twenty-one small guns, distributed in five batteries; nine little north of the village, eleven old guns in addition to seven small guns were mounted in embrasures cut in the rock. On the left bank descending south from the Kowlin Island the defences included a succession of batteries, some being armoured, and armed with nine 7-inch and two 8-inch Armstrongs, with numerous guns of inferior calibre.

At noon, on the 26th of August, the Duguay-Trouin and the Triomphante opened fire on the first defences of Mingan. At three o'clock their fire ceased after having bombarded each of the batteries in succession.

Operations of the 27th August.

On the 27th in the morning the landing companies of the Villars and the D'Estaing were sent ashore on the left bank, where they drove away the few Chinese who presented themselves, and then proceeded to destroy all the enemy's guns with gun-cotton. At half-past nine the landing parties returned on board, and at one o'clock all the ships weighed with the flood and steered for the narrows of Kimpai. Immediately on their arrival at this point, at three o'clock, a battery of old guns on the left bank opened fire. They were promptly silenced by the Triomphante. The Admiral signalled to the squadron to anchor near the Château Renault and the Saone. His intention was not to force the pass until the next day, the lateness of the hour making it impossible for him to complete the operation before nightfall. At half-past four a steam launch was sent to reconnoitre the approach to these narrows. She was followed by the Duguay-Trouin with the Admiral on board, who wished to make a personal examination of the defences. It was discovered that the barrier of junks which had been contemplated by the Chinese was not in place, but junks loaded with stones were moored to the bank ready to be sunk. Apprehending that they might be utilised for this purpose by the enemy during the night, it was determined to destroy them without delay. The boats of the Château Renault, protected by the gunboats Vipère and Aspic, were ordered for this service, and the junks were set on fire.

In the meantime, from the entrenched camp of the Chinese, a heavy fire of small arms was opened upon the gunboats, causing some loss of life, including Lieut. Bouet Willaumey.

Operations of the 28th August.

The narrows being cleared of obstructions at the upper end, the Commander-in-Chief was able to advance. He resolved to force a passage on the following day, the 28th. The enemy had concentrated all his efforts on the defence of the passage, which is not more than 400 metres in width, with high wooded hills on both sides. It is defended by numerous works, of which two were exceedingly strong.

On the right bank was a semi-circular battery, with five guns of heavy calibre, and the Fort Kimpai, a new armoured battery containing two 7-inch guns. Between these two batteries on the bank of the river were four guns. A large walled enclosure crowned the summit of the heights. On the left bank was Fort Blanc, built of stone, and armed with four 7-inch and one 8½-inch guns *en barbette*. The guns could be pointed towards the mouth of the river and across the stream. There were other small works.

On the 28th, at four o'clock in the morning, the Duguay-Trouin and the Triomphante weighed and approached the narrows, where they anchored. At daylight they opened fire. Having disposed of some smaller works, they commenced a combined attack on the Fort Kimpai. Following the plan adopted by the Admiral, the embrasures were destroyed in succession, cable being veered gradually to enable the ships to drop down upon the Fort. Having completed the destruction of Fort Kimpai, the Triomphante made an equally successful attack upon Fort Blanc, destroying the embrasures in succession. At half-past eight Fort Kimpai was no longer in a condition to offer any opposition to the passage of our ships. At nine o'clock dinner was served to the ships' companies. At half-past eleven the Duguay-Trouin and the Triomphante weighed, and anchored a little outside the positions they had taken up in the morning. They completed the destruction of every fort not already in ruins, and then weighed to attack the batteries at the entrance of the narrows. The battery mounting three old guns near the water's edge was abandoned. By noon the forts, the casemates, and the batteries were completely destroyed. The French fleet had no further obstacles to encounter, and the Admiral was at last able to issue forth into the open sea from the mouse trap in which he had been shut up for forty days. On the 30th the Admiral published a highly complimentary order of the day to the officers and men engaged.

GUNNERY AND TORPEDO EXPERIMENTS ON THE HULL OF THE IRONCLAD SHIP RESISTANCE.

(The substance of this article is taken from the *Times* reports of the several experiments.)

In the summer of 1885 it was decided by the Admiralty to carry out a series of experiments to ascertain by actual trial the effect of quick-firing guns and Whitehead torpedoes on the hull of an armoured ship. For this purpose the Resistance was selected, and the hull was prepared so as to represent approximately the hull of one of our modern ironclads so far as the unarmoured portion of the ship is concerned.

A considerable delay, however, occurred in preparing for the actual trials, and it was not until the 26th of August, 1886, that the first trial took place.

Experiments with india-rubber.

The object of this first trial was to test the merits of india-rubber and asbestos fibre as a means of plugging shot holes, and as it is of transcendent importance to ascertain the effect of shell fire below deck, and also the efficacy of any means that can be suggested, for arresting or minimizing the inflow of water after the penetration of a ship's sides, the authorities are to be congratulated on the daring innovation of testing theory by operations upon a ship itself. The use of indiarubber lining in this case was proposed by Captain Fitzgerald, and the Resistance was fitted for the trial under his own direction before leaving Devonport in the Bellerophon. Four compartments were built in the bows on the port side at the water line on the water-tight flat immediately below the lower deck, and consequently in wake of the thin plating of the hull, which is $\frac{5}{8}$ of an inch thick. These compartments were 4 ft. deep, 5 ft. broad, and varying from 10 to 13 ft. in length. They were formed by fitting an iron screen $\frac{5}{16}$ of an inch in thickness between consecutive athwart ship bulkheads of the ship, thereby forming a sort of improvised longitudinal bulkhead. The inner side of this bulkhead was coated with india-rubber of different thicknesses, two of the compartments being lined with half-inch and the others with sheets of an inch and an inch and a half respectively. On the starboard bow a patch of rubber an inch in thickness was placed on the exterior skin (thin plating) of the ship without any interior protection, and contiguous to this was a cell of circumscribed dimensions filled with asbestos packing, to which it would be imprudent to allude more in detail. Both these devices covered the water line. As soon as everything was in readiness 200 blue-jackets were set to work to cant the hulk to starboard, so as to bring the compartments on the port side fairly out of the water. This was achieved by shifting 200 tons of iron ballast across the deck. The Pincher gunboat was then moored to a buoy at a range of about 100 yards from the ship, and the fourth compartment, the one farthest from the stem, was attacked by the quick-firing gun. This gun has a calibre of a little over a couple of inches and throws a shell of six pounds, containing a burster of half a pound. The sea was smooth, and as the light was all that could be desired, the projectile hit the target with admirable precision. The Blazer now superseded the Pincher, and attacked No. 3 compartment with the 5-in. breechloader, which discharges a shell weighing 50 lb., and having a burster of 4 lb. 12 ozs. The charge was equal to 16 lb. After this round an examination was made on board to ascertain the extent of the mischief which had been inflicted below. India-rubber is in its very nature a perishable material, and, even had it fulfilled the end desired, it would be somewhat objectionable for this reason, but it lamentably failed in the primary object. The rounds from both the light and the heavier shell-guns not only pierced the bulkhead 5 ft. from the side, as they were expected and intended to do, but, as was also feared, they had shattered the rubber coating and cut it into strips. Against shot rubber has been known to succeed in closing up the well-defined perforations, but shell fire is quite another matter. The gun to be employed against compartments Nos. 2 and 1 was to be determined after the effect of the first two rounds had been discovered. As the lighter natures had played such frightful havoc it was not deemed advisable to bring a more powerful gun into requisition. The results of the firing upon the other compartments were much about the same. As the 5-inch gun had so cruelly punished the inch and a half protected bulkhead in No. 1 compartment, it was thought desirable to see whether its resistance to the power of a rapid-firing gun would be more satisfactory, but as a matter of fact, owing doubtless to the circumstance that the small shells happened to hit where they could do the most harm, the damage wrought by them was found to be even greater than by the more powerful weapon. Had the defence proved approximately successful, it was intended to have heeled the ship over to port so as to bring the shot-holes under water for the purpose of observing the action of the rubber in keeping out the sea. As, however, each shell had exploded within the compartments, and as a consequence the rubber had been lacerated and scattered under the test and the screen was rent, this was clearly unnecessary, and the men were sent to plug up the wounds by means of the usual plugs and stoppers. The Resistance having again been made tolerably water-tight, she was heeled over so as to bring the rubber patch and the asbestos cell out of the water. These were attacked in their turn by the 6-pounder, three rounds being fired against the former and one against the latter. The results were considerably more satisfactory, as projectiles passed through the rubber intact. Two of the perforations when looked through on the inside exhibited no defined hole, but a series of radial cracks or cuts, while the aperture made by the third shot had closed, though not so completely as to keep out the sea altogether. The asbestos, on the other hand, had completely answered its purpose, not as was supposed by swelling or through any elastic property, but by a change of substance, it having been converted into a sort of paste or putty by means of absorption. When the ship was heeled over and the cell was brought under water it appeared thoroughly to do the work that was intended. The last shot fired pursued a somewhat erratic course. Hitting an iron frame, it ricocheted through the deck above, and made an indent against the overlying deck, the fragments keeping up a continual rumbling as though searching for a means of exit. This concluded the first part of the programme, and the Resistance was towed into harbour in the evening to be prepared for an assault by torpedoes in the region of the midship section and below the armour protection.

On the 21st of September a charge of 80 lbs. of compressed gun-cotton was exploded at a distance of 30 ft. from the ship's side without doing any appreciable damage; the ship received a severe shaking, but was not crippled.

Experiments with the torpedo.

On the following day the practical experiments of the Whitehead torpedo against the hull of the Resistance really commenced. These important experiments were undertaken for the purpose of determining by precise practical tests—1st. The shortest distance from the ship at which a Whitehead torpedo can be exploded by means of defence nets without injury to the ship.

2nd. The value of coal armour as a protection for the double bottom and other unarmoured portions of the hull against the force of Whitehead torpedoes.

3rd. The effect of a Whitehead torpedo when exploded in actual contact with the ship.

Experiments on Oberon.

It will be remembered that many years ago certain experiments were made on the hull of the Oberon, which had been specially prepared for the purpose of representing an ordinary ship of war with a double bottom. The attacking weapon in that case, however, was a ground mine, and the mine was exploded by electricity at a considerable distance from the ship.

Five hundred pounds of damp gun-cotton were used, and were sunk in 47 ft. of water, and at an absolute distance of 100 ft. from the outer plating of the ship. The horizontal distance was subsequently reduced to 80 ft., 60 ft., and 50 ft., but without inflicting mortal injury upon the hull, which though wrecked internally still continued to float. Eventually the mine was sunk at a depth of 48 ft. from the upper edge of the double bottom amidships, and at a horizontal distance of 38½ ft. from the keel. On the charge being fired the ship appeared to rise bodily in the water; she had been struck amidships, and it was found that her back had been broken by the explosion. The water-tight transverse bulkheads which she possessed, however, secured sufficient buoyancy forward and aft to keep her afloat, and she was ultimately towed into Portsmouth Harbour after some repairs to her hull had been carried out.

The torpedo experiments on the Resistance differ, however, from those on the Oberon, and were mainly intended for ascertaining the effect of the explosion of a Whitehead torpedo at or near the side of an ordinary ironclad ship, and for settling many practical questions connected with torpedo attack and defence, which required solution in actual use in marine warfare.

Attack on Resistance. Explosion 30 ft. from hull.

The Resistance being among the first of our early ironclad ships, certain alterations were necessary in order that she might be made to represent approximately the hull of a modern ironclad. The spaces below the armour shelf were so arranged as to represent as nearly as practicable the actual coal defence bunkers now adopted for the protection of the engines, boilers, &c., of a ship of war against torpedo attack. The spaces named were divided into two nearly equal compartments by an iron vertical longitudinal bulkhead, and the space next the outer skin was filled with coal.

On the outside of the ship were fitted torpedo service nets with iron booms of a new description, and it was a part of the programme that the distance of the nets from the ship's side should be varied with the view of ascertaining the minimum distance at which a Whitehead torpedo might be exploded by them without serious injury to the structure of the ship. Torpedo nets and booms being heavy and cumbrous for handling, any reduction which could be safely made in the length of the boom, or, which is the same thing, the distance of the nets from the ship's side, would be a great gain; and if the reduction were considerable, it is clear that the nets might be used at a higher speed than would otherwise be the case, and the gear would also be worked much more easily, with fewer men and in less time.

The object of the experiments being to ascertain the effect of a palpable hit, some sacrifice of practical conditions had necessarily to be made to insure the torpedo striking where it could inflict the greatest injury. In actual warfare it is assumed that the burst of a Whitehead torpedo would prove fatal to a ship wherever it came in contact with it, but in these experiments it was essential that the Whitehead should hit the ship in a particular spot or compartment—the target being 29 ft. in length fore and aft, and in depth from the armour shelf to the turn of the bilge. To insure accuracy of fire therefore the ship was moored forward and aft in Porchester Lake, and in order to obviate the effect of currents, and to give the torpedo the advantage of deep water, the time of high water was chosen for carrying out the experiment.

The weapon used on the occasion was the old 16-inch Whitehead torpedo, which has for some time and for certain reasons become obsolete in the service. For the purpose of the experiments it was however, thoroughly efficient, indeed more efficient than the weapon now in use, as the charge is 91 lbs. of gun-cotton as against 65 lbs. of the modern 14-inch Whitehead, and its use obviated the necessity of destroying a new pattern Whitehead valued at some £400.

The torpedo was fitted with the new pistol trigger, which is extremely sensitive and explodes the charge upon traversing the meshes of the wire netting.

At five o'clock everything was ready for the trial. The torpedo vessel Vesuvius was at this time at a remote distance to the westward. The effective range of the improved Whitehead is stated to be 600 yards, but as it was expedient to attack the net defences of the Resistance at close quarters, the Vesuvius got under way and passing the ship, at the distance of about 100 yards discharged the projectile. The path of the torpedo through the water was clearly indicated by the air bubbles which it threw up, and the net defences were struck a little forward of the target. Although the visual force of the explosion was very great, persons who expected to see the ship very much damaged were disappointed. As soon as the fountain of water thrown up had subsided, it was manifest that the netting had served the intended purpose, and that as far as could be seen the ironclad remained uninjured. The nearest boom had been unshipped from its support, but all the others remained intact. The meshes of the net in the immediate vicinity of the explosion had been carried away, but the area of actual destruction was so small that a second discharge would have proved just as harmless, unless it happened to have passed through the rent in the net inflicted by the first.

Explosion 20 ft. from hull.

The foregoing experiment having shown conclusively that the progress of a locomotive torpedo, such as the Whitehead now in use, could be effectually arrested by the ordinary service-net protection, and that the explosion of a full charge of gun-cotton at the net placed at a distance of 30 ft. from the ship's side was perfectly innocuous, the next step in the programme was to test the effect of shortening the length of the booms or the distance of the wire nets from the ship's side. On September 24th, therefore, the attack on the Resistance was advanced to closer quarters, and as the value of the nets had been demonstrated, it was deemed no longer necessary to employ costly Whiteheads in the assault. A fixed charge of gun-cotton representing the normal explosive energy of a Whitehead was accordingly slung from the booms at a distance of 20 ft. from the skin plating (10 ft. nearer than before), and submerged to the depth at which a torpedo would be set, and afterwards electrically exploded from a cutter. The explosion produced the usual detonation and spout of water, but its force expended itself in the air without inflicting any perceptible damage to the ship's hull, which still continued to hold its own. A second charge of the same character and weight was afterwards sunk 5 ft. nearer the ship, that is, 15 ft. from the side, and exploded in a similar way. In this case the differences were manifest and significant. Though the volume of water thrown up was about the same, the detonation was less diffused, and whereas the previous spout was perfectly clean, the outer ridges of the dome in this instance were discoloured with mud, and presented a very vague outline. The Resistance was greatly strained and shaken and, though the booms remained in place and none of the bottom plating was displaced, it began to leak, until eventually the wing passage in wake of the target compartment became filled with water, and several runlets found their way into the bilges.

After the above trial had taken place, the ship was found to be leaking so badly that it required the assistance of upwards of 200 blue-jackets at the pumps to keep her afloat. As the bottom plating was uninjured by the shock, it was not ascertained at the time how the water found an entrance; but on being docked after the experiment, it was discovered that one of the suction pipes connected with the Kingston valves had been fractured. This having been repaired and the seams in the defensive bulkheads which were fitted at Devonport thoroughly examined and made water-tight, the old iron-clad was undocked and towed to her former moorings in the remote upper reaches of the harbour for further experiments.

18th October. Experiments recommenced.

The experiments were recommenced on the 18th of October. The attack on this occasion, instead of being a step in advance, was in some respects retrograde. The first Whitehead directed against the ship was exploded against the wire nets boomed out 30 ft. from the ship, while that fired at it on the 18th of October was similarly exploded 25 ft. from the side, the projectile being in each case one of the old 16-inch Whiteheads. In the interval, however, the ship had resisted the explosive force of fixed charges up to within 20 ft. from her side. The latter charges were, it seems, less heavy than the weight of gun-cotton stored in the head of a locomotive torpedo, and their effect may consequently be supposed to be less destructive than a Whitehead exploded under the same conditions. But if this be the case, it is not easy to perceive the value which attaches to the intermediate experiments. The result could not in that case be said to represent that of the Whitehead, because of the difference in the charge; nor that of the spar torpedo, because of the distance at which the charge was fired from the ship; nor that of a ground or buoyant mine, because of the smallness of the charge and the difference of its position relatively to the object. The experiment was a return to practical conditions, for, although an obsolete weapon was for economical reasons used on the occasion, it is to be presumed that the service charge of a 16-inch Whitehead, which is said to be 90 lb. of gun-cotton, was reduced to the proportion of that of the modern 14-inch torpedo, which would be used in the actual circumstances of war, and the effects of which against an ironclad it is the purpose of these experiments to determine.

The time fixed for the trial was half-past two, or near upon high tide. As soon as the red flag on board the Resistance was hauled up to the head of the staff to show that all was ready, an answering signal was hoisted on the Vesuvius torpedo ship, which presently got under way and steamed slowly down towards the ship. When opposite she turned so as to bring her stem directly in front of the target amidships, and discharged a Whitehead from her submerged port at a distance of about 200 yards. Every one watched with suspended breath the course of the missile, which was easily followed by reason of the line of air-bubbles which it threw up in its train. As soon as its pistol trigger came in contact with the meshes of the net the charge exploded, sending up a jagged fountain and producing a great amount of churning in the water, but it was presently seen from the single spout ejected and the purity of the water upheaved that the lateral extension of the explosion was small, and that the energy of the charge had, as on the previous occasion, exhausted itself in the air. A sort of shudder passed through the hulk, but it was evident that it had again passed scathless through the ordeal, with the exception of the rear boom in the wake of the target on the side, which had been blown away from its hook, apparently demonstrating the weakness of the existing hinge arrangement. A strong working party of blue-jackets were sent on board to man the pumps if thought necessary, but their services were not called for. As a precautionary measure the dockyard diver was sent below to examine the ship's bottom, and he reported that none of the skin plating had been either injured or started, and that not a rivet appeared to have been shorn off.

2nd November. Explosion in contact with ship.

The torpedo experiments against the Resistance moored forward and aft in Fareham Creek, Portsmouth, reached the culminating point on the 2nd of November, the attack having suddenly approached at a bound a range of 25 feet to actual contact with the ship. The interest aroused by the experiment was greater than on any previous occasion, as nothing less was expected than that the ironclad would receive its quietus, and be either blown to pieces or sunk. It was also the first time that a real Whitehead had been exploded in actual contact with a real ship of war, and it was hoped that much information would result, not only as regarded the destructive effects of the engines fired at close quarters, but with respect to the value of double bottoms and coal bunkers in withstanding the effects of the burst, and the importance of water-tight bulkheads in localizing the inrush of water. The result proved a disappointment for the attack, in spite of the considerable injury that was inflicted. As a matter of fact, the ship was placed under every disadvantage, while everything was done to add to and aggravate the power of the assault. The Resistance was placed in chancery, so to speak. She was deprived of her net defences and moored in shallow water, while a 16-inch torpedo, charged with 93 lb. of gun-cotton was lashed to a boom and placed longitudinally fore and aft in contact with the port side of the hulk amidships. The submersion was about eight feet, which brought the torpedo immediately above the bilge keel, and the torpedo was about a foot within the main breadth of the ship. The torpedo was exploded upon a falling tide. The shock was not greater than in previous experiments, and the amount of water thrown up not unusual. So far as sensation was concerned, the effect was tame and disappointing, for the simple reason that something extraordinary was counted upon. The ship was thrown slightly to starboard by the energy of the explosion, after which she slowly listed to port, but not much. It was evident that her bottom had been damaged, and that, notwithstanding the application of a collision mat, water was finding ingress—in fact, the mat was useless, as there was no rush of water to force it into the rents. As an observation of the water-line showed that the ship, after heeling over to a definite angle, remained stable, it was supposed that she had touched bottom and that she would inevitably have sunk had she been moored in deep water, but subsequent investigation proved that she was still afloat and could have been brought into harbour if necessary. The bilge keel had been shaken off and broken to the extent of 20 ft., while the plating below was very much indented. Above the bilge keel three or four strakes of the skin plating, extending up to the armour shelf, had also been forced inwards where they crossed the longitudinal frames. They had parted in the middle for the length of 8 ft., while some of the butts had been opened so that gashes two and three inches wide appeared at the junction. There were also a few holes observable in various parts. Internally the skylights had been smashed and the contents of the bunkers scattered in all directions. The exact amount of the damage done inside could not be accurately known until the ship had been docked. But what is of greatest importance is the fact that the water-tight bulkheads remained intact, and, by confining the water to one compartment, sufficed to keep the Resistance afloat and capable of fighting her guns. Indeed there is no resisting the impression from these experiments that the value of the Whitehead has been greatly exaggerated. The torpedo cannot get through the steel protective nets, and when it dashes itself against them and explodes, the consequence is *nil* at a distance of 25 ft. It also remains to be mentioned that this test was scarcely a practical one, as the missile was fixed against the side of the ship. The effect of a Whitehead striking at a great speed and also that of the explosion upon the boilers and steam pipes of the Resistance or some other ship under a working pressure of steam might be made the subject of a special trial.

Experiments in 1887.

The torpedo experiments against the Resistance, which had been suspended since November 1886, were resumed at Portsmouth on 9th June, 1887. After having had the wounds inflicted in previous encounters patched up and made water-tight in various ways, the ship was towed up the harbour and moored in Fareham Creek. Of course it need scarcely be said that the Resistance is an ancient ironclad which has finished her career as a battleship, and that nothing short of rebuilding could convert her into a modern armourclad. The Admiralty, the dockyard, and the torpedo officers have, however, taken the utmost pains to render the experiments final and conclusive as a practical demonstration under service conditions of the destructive effects of the Whitehead torpedo when directed against a modern vessel of war, and there is no doubt that a close approximation to the modern ironclad ship has been secured. The construction of the double bottom is of course different, but since the experiments of 1886 were carried out against her, measures had been taken to make her as far as possible the counterpart, in respect of under-water arrangements and coal protection, of a modern ship of war.

At the last attack the Whitehead was directed against the after part of the hull on the port side. In this series of experiments it was intended that the old ship was to be assailed on the same side, but directly amidships, in the neighbourhood of the engine-room. The rending effect of the force of the explosions would it was thought be considerably increased through the depressing weight of the ends, while the danger to the crew from the resulting damage to the machinery and steam connections in action would also be greater. But as it was not proposed to get up steam in the boilers, the effect of the jar upon the steam pipes, glands, and feed connections would remain a matter of speculation. So far as the consequences of the burst upon the structure of the hull itself was concerned, every care had been taken to make the ordeal as complete and instructive as possible. The wing passage, which has a *maximum* breadth of 3 ft. diminishing to nothing, was left empty, although at the former experiments the lower portions of this passage were filled with coal. Behind this, and at a distance of 8 ft. from the wing bulkhead, a longitudinal or fore and aft steel bulkhead ⅝ in. thick had been worked to a length of 61 ft., and, with the coal with which the intervening compartment was packed, formed (as in recent armour-clads) a solid rampart, 20 ft. high, for the defence of the engine-room. The height of the double bottom between the outer and inner skin plating was about 2½ ft. The water-tight compartments were traversed by vertical plates pierced by three large holes for the purpose of lightening them, and in order to make them, as far as was practicable, resemble the bracket frames of a modern armourclad, the centre of the plates was cut away, so as to leave a single oval hole in place of the three circular holes previously referred to. So far no objection could be taken to the means adopted to test the actual effects of a torpedo exploding against the unarmoured parts of a ship of war. These modifications were made to bring the construction of the target—the old iron hull—in conformity with modern practice. Something more, however, had been done, and must be considered as quite apart from the target representing the modern ironclad. With the view of testing the value of thick plates on the bottom of a ship as a defence against torpedoes, some steel armour plating 1½ in. thick had been worked on the outside skin at the upper part of the wing passage. The experiment would no doubt be of value as guiding future constructions, but of no value in reference to existing ships. It does not appear, however, that the portion of the structure so strengthened was put to any actual trial in any of the subsequent experiments.

9th June, 1887.

The Resistance had been brought down by iron ballast to a trim of 25 ft. 9 in. aft, and 19 ft. 7 in. forward, giving a mean draught of 22 ft. 8 in. She was consequently rather more down by the stern than before, but was in other respects the same. When in commission the Resistance had a mean draught of 26 ft. 10 in. But however desirable it might have been to immerse her to her original load line, this was rendered impracticable from the want of water in the creek. This series of experiments promised to be of even greater importance than the first series. The attack was gradually developed by means of fixed and outrigger charges of increasing power, and the *coup de grace* was not to be given by means of a service Whitehead in actual contact until various lessons had been learned. The opening experiment on the 9th June consisted of an attack directed against a new system of torpedo defences which are to be carried by ships in action, or when in expectation of an attack, rather than an assault upon the ship herself. The previous experiments had clearly demonstrated that a Whitehead when projected against a vessel at close range, and consequently with a *maximum* of motive force, could not get through the ordinary wire netting before expending its explosive energy in the air, and that the spars by which the nets are boomed out from the ship's side could be reduced to 25 ft. in length without danger to the hull. The ordinary wooden booms employed on board ship, however, are heavy and unwieldy, weighing as they do more than half a ton each. In ordinary circumstances the spars cannot be lowered into place and the nets made taut in less than a couple of hours, and the work of stowing them is equally slow and laborious. Mr. Bullivant, who manufactures the torpedo netting and steel hawsers has devised a method of getting rid of the difficulties complained of by substituting steel booms for the wooden booms, and an arrangement of pulleys and runners, whereby the protection can be run out and in, topped and brailed up out of the way, with great facility. The system was tried at Portsmouth last year with considerable success upon the Dido, but as it was thought that some of the fittings were somewhat frail and might collapse beneath the shock of a live torpedo, it was resolved to submit them to a practical test under service conditions upon the Resistance. The ship was consequently fitted with three of the steel booms on the port side. They were 32 ft. long and spaced 45 ft. apart, and connected by a jackstay to which the nets were attached. Each steel boom weighed 5 cwt., or less than half the weight of the ordinary boom, and whereas the latter is fixed to the ship's side by a hook which is liable to be disconnected or broken by the jerk of an

Bullivant torpedo net fittings.

exploding torpedo, this new steel boom works in a universal or socket joint, which cannot get out of gear except by fracture, and which permits the boom to be moved in any direction, whether vertically or fore and aft close in against the sides. Below each boom is a flange, which serves as a line along which a traveller moves, the latter being actuated by means of a topping line running over a pulley at the head and another near the heel. Upon the booms being topped to a vertical position, the nets are attached to the runners at the bottom of the booms close inboard (instead of under the existing system to the tops of the booms from boats alongside or otherwise), and when this is done the mere depression of the booms into position will cause the nets to run out of their own accord. In like manner, when the occasion for their use has passed, the raising of the boom will cause the nets to come alongside, when they can either be brailed up through the grummets or disconnected for future use. The action of the gear is so simple and rapid that the torpedo protection can be always ready without arresting the way of the ship. As a length of net 30 ft. by 20 ft. deep weighs about 3 cwt., it will be seen that the reduction of strains by working the crinolines from the heel instead of the head of the booms is considerable.

The attack by the Whitehead upon the booms and nets was made at the time of high tide. The proceedings were understood to be of a strictly confidential character, but facilities were granted to the dockyard officers and also to the naval and military officers belonging to the port and garrison to witness them, although no measures were taken to inform them as to the nature and value of the experiments. The whole affair occupied a very few minutes. As soon as the red pennant was struck on board to show that the arrangements were satisfactory and that the target was ready, the torpedo vessel Vesuvius got under way, and after circling round the doomed hulk discharged a Whitehead against the netting from her under-water bow torpedo tube at an approximate range of 50 yards. As on former occasions, the missile was one of the old 16-in. pattern, but it was understood that the charge of gun-cotton had been reduced to 87 lb., so that the net protection should not bear a greater strain than would be the case in actual hostilities. The torpedo, which was set to a depth of about 10 ft., struck the net in the middle, and threw up an immense spout of water, but without getting to the ship, which was apparently uninjured. Although it hit the net immediately below the centre boom, no fracture occurred, and the points remained intact. It may also be mentioned that, although at the short range the torpedo would spin through the water at a great speed, and would deliver a formidable blow upon the net, the thrust was effectually resisted, though, as a matter of course, the net was much torn by the explosion of the baffled projectile.

10th June, 1887. The second torpedo attack of this series upon the Resistance at Portsmouth was made on the 10th June, 1887, and although the offensive power that was brought to bear was quite exceptional, the victory so far remained with the ship. The hulk is perfectly motionless. The enemy can deliver his attack without interference on the part of the attacked, he can execute his operations in his own time, he can employ his most expert and capable torpedoists (professors of the art, in fact), he can use whatever charges he likes, and can place them just where he thinks they will do the most mischief. Nor must it be forgotten that the target in this instance was not a fresh one. It had been tattered and torn by previous conflicts with submarine enemies, and had had its honoured scars plastered over on the inside by planking and other surgical artifices, and yet with all these great advantages in favour of the attack, the Resistance continued not only afloat, but was to all appearance as tight as a bottle, with the exception that a few trivial runlets managed to find a passage in the region of the old sores. The charge exploded was an exceptionally heavy one. It consisted of 220 lbs. of gun-cotton. It was consequently more destructive than any which is ever likely to be launched against an armourclad much better prepared to resist it than the obsolete and time-worn Resistance. An idea, however, had got abroad that the Russians either have or intend to have a locomotive torpedo capable of carrying the same weight of explosive in its head, and the object of the experiment was to ascertain what would be the effect of the detonation of such an enormous charge upon the submerged portions of a ship of war. But while this was no doubt the primary purpose in view, the experiment also served the secondary purpose of determining the result of the explosion upon the net defences of a ship.

Mr. Bullivant's patent booms and runners, which were found to be scarcely anything the worse from the ordeal of the previous day, were again used. The damaged net was taken away and one of the old service grummet nets slung in its place, the cylinders containing the gun-cotton being attached to the jackstay immediately in front of the battered sides, and 30 ft. from the hulk, and sunk to a distance of 20 ft. below the water line, which would bring it about opposite the bend of the bilge. By 3 o'clock, P.M. everything was ready for the explosion of the charge—everybody had cleared out of the ship—and the surrounding small craft had drawn off to a distance of 300 ft.

The charge was electrically fired from a pinnace. The burst was terrific and the reverberation was heard and the shock distinctly felt in the dockyard. But the remarkable thing was that the hulk did not appear to jump in the least, although there was not more than 6 ft. of water under her keel. That she would not be seriously crippled by the discharge seems to have been accepted as a foregone conclusion by Captain Long and the other torpedoists, as the day for the third experiment had been fixed in advance; but that the steel booms with their double-flange running ways, stays travellers, and hinges should have resisted the tremendous jar and upheaval was a genuine surprise for all concerned, and goes far to prove that except a vessel be taken unawares it will be impossible for a Whitehead torpedo of the kind and size now in use to come into actual contact with it. At the experiments last year the wooden booms were unhinged and splintered under a much less violent shock. But the steel booms employed, though somewhat bent, remained unbroken and in position, and the joints were quite uninjured. All that is necessary for perfect defence is that the booms should be made a little heavier.

13th June, 1887.

The torpedo experiments against the Resistance were resumed at Portsmouth on the 13th June. As the experiment was understood to be the last of the second series, and was fully expected to have a sensational termination, a considerable number of interested spectators were attracted to the scene in Fareham Creek, including a number of photographers, amateur and professional, who hoped to catch and perpetuate the dying throes of the brave old ship. For some time before the impending convulsion occurred all eyes were riveted upon the object, and as there was nothing to inform an observer outside the ring of officials when the supreme moment had arrived, the probability is that the artists were too startled by the shock to attend to their cameras. The torpedoists resorted to severe measures, but with a distinctly useful purpose in view, having bound the ship hand and feet, so to speak, in such a way that her name became a solecism. They exploded 95 lb. of gun-cotton 20 ft. below the water and in contact with her double bottom. This amount of explosive represents the full charge of the old pattern 16-in. Whiteheads, but as the hulk was for prudential reasons moored close to a mud-bank, and as the water was consequently much too shallow to allow of a locomotive torpedo being set to run at the required depth, a fixed charge was lashed fore and aft against the bottom plating of the ship and electrically exploded from No. 95 torpedo boat.

In previous experiments this year the ironclad was attacked on the port side, which had been specially prepared for the occasion, and the result, as we have pointed out, was a victory for the defence. On this occasion the starboard side was selected for attack, in order that a comparison might be instituted with the effects produced under different conditions by a similar experiment. Last year in the latter case the double bottom was filled with coal, and after the charge, which was lashed against the ship in the same way, had been exploded it was found that the bilge keel had been shivered for a length of 20 ft. while the outer bottom plating had been much bulged above the bilge keel. Four strakes of the skin plating extending up to the armour shelf had also been forced inwards and fractured where they crossed the longitudinal frames. They had parted in the middle for a distance of 8 ft., while some of the butts had been opened so that gashes 2 in. or 3 in. wide appeared between them. The coal had been pulverised and scattered in all directions, and other internal damage inflicted. Nevertheless, the water-tight bulkheads remained intact, and by confining the influx of water to a single compartment, so much buoyancy was preserved that, though the ship heeled over to starboard and was maimed, she remained afloat, and might have continued to fight her guns, provided always that no injury had been sustained by her machinery, a point which these experiments do not touch. Crippled, however, as she was, it was thought at the time (and the probability was strengthened by subsequent examination of the ship in dock) that the coal instead of being a protection to the double bottom had in reality proved a source of weakness by receiving the energy of the explosion from the outer plating and communicating it to the inner plating, and so distributing it throughout the submerged portions of the hulk. Were this reasoning just, it will be seen at once that by packing the space between the two bottoms with coal, the essential purpose of a double bottom, which is to keep the ship afloat by means of the inner skin after the outer skin is injured, was vitiated. The question was sufficiently important to demand an experimental solution, hence the *raison d'être* of the present experiment. The double bottom, which is about 2½ ft. deep, was consequently kept empty, and the torpedo placed in immediate contact with it in such a manner that, being overhung by the contour of the hull, the ship would feel the full force of the upward as well as the lateral energy of the charge. On other accounts the importance of the experiment was obvious; for although it had been ascertained that torpedo nets were capable of protecting a battle-ship from the bursts of the heaviest locomotive and outrigger charges, it might happen, of course, that the nets would be rent or displaced by shell fire or swept away by a grazing ram, or even attacked by a double torpedo, the second passing through the gashes made by the explosion of the first in any case.

It was of urgent necessity that the effect of a torpedo bursting in immediate contact with a ship's bottom should be practically and clearly determined. The charge, which as before stated consisted of 95 lbs. of gun-cotton, was fired against the ship's side in the wake of the boilers, and it was soon perceived that something of a fatal character had taken place from the appearance of coal dust sweeping up through the hold. The report had not the dull boom to which the spectators had become accustomed. Instead of this, the gun-cotton exploded with a sharp, angry, whistling noise, while the manner in which the mud was churned up showed that the force of the rebound was terrific. The ship lifted bodily near the stern, after which it was seen to leisurely heel over to starboard some eight or ten degrees, and finally repose, though not until the tide fell, upon the mud. The old hulk had been mortally wounded at last. A complete knowledge of the disaster which had overtaken her could not be obtained until a careful investigation had been made of the hull in dock. But, from a hasty exploration which was conducted on board, it was evident that the shot had not only dislocated the inner plating of the double bottom, but had penetrated the bunker compartment, stored as it was with coal, that the water-tight doors and compartments had ceased to operate, and that water was flowing into the hull through a hundred crevices. To such an extent was this the case that, though a strong working party was at hand ready for any emergency, it was deemed useless to attempt to free the ship of water until her gashes had been temporarily closed from outside. When this was done she was pumped out and brought into dock for careful examination. From what has been said, it will be seen that, while the explosion of 95 lb. of gun-cotton in actual contact last November simply crippled the Resistance, the explosion of a like charge at the same spot, and under approximately the same conditions, in this instance not simply disabled, but really sunk the ship.

We have seen no report of the condition of the ship's hull on docking, and we do not know the precise lessons which have been taught by these experiments. They, however, appear to us to show:—

1. That the nets in ordinary use will efficiently stop a Whitehead torpedo of the present pattern and weight, and that no serious injury would be done to the hull of a well-constructed ironclad ship by the explosion of the torpedo at the nets when they are placed at the small distance of 25 feet from the ship's side.

2. That the Bullivant gear is a considerable improvement on that previously fitted in our ships, both as to durability and as to convenience in handling.

3. That the structural arrangements of our ironclads are good.

4. That as far as practicable coal should be stowed close to the outside plating of our ships in preference to having the spaces adjacent to the outside plates empty.

WITHDRAWAL FROM PORT HAMILTON.

The withdrawal of our naval forces from Port Hamilton, which had been temporarily occupied under the apprehension of war with Russia, has been condemned by Sir Charles Dilke. He regards it as a surrender to Russia in the North Pacific. An attack on Vladivostock is an operation which the Navy must undertake in the event of a fight with Russia, and we could, without doubt, carry the struggle to a successful issue; but the arguments urged by the three able naval officers who have in succession commanded on the China station show conclusively that the retention of Port Hamilton would rather impede than assist that forward movement which, in eventualities that we refuse to anticipate as probable, Sir Charles Dilke recommends. The considerations by which naval opinion has been determined are clearly set out in the papers presented to Parliament, from which the following extracts are taken:—

Extract from Letter from Admiral Sir G. Willes to Lord George Hamilton.

Admiralty House, Portsmouth, January 7, 1886.

I went to Port Hamilton several times during my command, and I still hold the opinion which I then formed that Port Hamilton is useless and expensive in ordinary peace time, and in war or during one of the "periodical scares" would be a source of weakness, as the Admiral in command would have to detach some of his ships to defend the islands (forming the harbour) instead of employing them in the protection of our commerce.

It was said last spring that if England did not take possession of Port Hamilton some other nation would.

A short study of the chart and a few minutes' reflection will show that this is absurd. Only the nation which "commands the sea" can hold our new acquisition, for the islands are practically barren.

It is supposed that in war a coaling-station in the northern part of the command is necessary. I am not of that opinion.

Steam colliers properly fitted must be filled with Welsh coal at Hong Kong, and follow our ships:

* * * * *

I therefore recommend the islands forming Port Hamilton being restored to their rightful owners forthwith.

Inclosure 2 in No. 50.

Vice-Admiral Sir W. Dowell to the Secretary to the Admiralty.

[Extract.] Audacious, at Nagasaki, May 28, 1885.

Referring to my telegrams of the 18th and 20th instant, reporting that I do not consider Port Hamilton a desirable place to hold, I beg leave to submit, for the information of the Lords Commissioners of the Admiralty, the following reasons in support of my views upon the subject.

There is no position in the harbour which could not be shelled by vessels from either one entrance or the other.

I should not propose to land coal at Port Hamilton, as, in the event of war it would be too far for ships to return there for coal. The squadron must be accompanied by colliers, and the bays and anchorage in the neighbourhood of the scene of operations utilized for coaling purposes.

I consider that if we are to hold Port Hamilton, fortifications must be thrown up, a garrison of not less than 500 men should be maintained, and three first-class torpedo boats. A corvette and two gunboats would also be necessary, and even with this force I consider that the place would be a source of anxiety and weakness in the face of an active and enterprising enemy.

It must be remembered that Port Hamilton has no resources in itself. It produces barely sufficient for the subsistence of its population, and no fresh provisions are procurable.

No. 59.

The Secretary to the Admiralty to Sir P. Currie.—(Received June 7.)

[Extract.] Admiralty, June 4, 1886.

Sir,—In reference to your letter of the 22nd ultimo in regard to Port Hamilton, I am commanded by my Lords Commissioners of the Admiralty to transmit, for the information of the Secretary of State, a

Report from Vice-Admiral Vesey Hamilton, dated the 21st April, 1886, inclosing the opinion of Captain Powlett, of Her Majesty's ship Champion, who has been stationed as Senior Officer at that place for about eight months.

Captain Powlett to Vice-Admiral Hamilton.

[Extract.] **Champion, at Kobé, April 7, 1886.**

Sir,—In compliance with your directions, I have the honour to make the following observations on Port Hamilton:—

1. Port Hamilton is a fairly good anchorage in all winds except those from the south-east, and then, in order to avoid the sea the wind brings from that quarter, it is necessary to get Shoal Point to bear about S.S.E., and the anchorage then available is very circumscribed.

12. From a naval point of view Port Hamilton is quite worthless. No one can hold it who has not the command of the seas, and if you have command of the seas, of what good is it? You must detach a division of your squadron to protect it: with what object?

13. The establishing of huge steamers makes a fixed secondary depot for a naval force no longer of the same consequence as was formerly the case, as all coals, provisions, &c., necessary will in all future naval expeditions, I apprehend, be carried in large steamers wherever the expedition goes; thus, secondary depots are no longer required. Port Hamilton is, however, too far from any possible objective point to be of use as a base of operations.

Vice-Admiral Hamilton to the Secretary to the Admiralty.

[Extract.] **Audacious, at Nagasaki, June 1, 1886.**

In continuation of previous correspondence on the subject of the occupation of Port Hamilton, I request you will inform the Lords Commissioners of the Admiralty that I have just spent two days there, and am the more strongly convinced of the inexpediency of retaining it as a naval station; in point of fact, I do not see a single point in its favour, and very many objections against it.

Unless it is strongly fortified, there are several points from which the ships laying in the harbour can be shelled by a smart hostile cruiser with impunity, or tremendously harassed by a ship passing to and fro the entrances (three in number) at night, and firing into the harbour.

Its retention weakens the naval force on the station very materially; but little protection can be afforded to our commerce to Japan from it, and none to our North China trade; no probable enemy could harass either unless China and Japan afforded them coaling facilities, which would, of course, also be afforded to us.

The documents already at the Admiralty will show their Lordships that the greater portion of this squadron, that should have been at sea protecting commerce, were employed trying to render this port secure against a hostile attack during the war scare of last year. To fortify it efficiently great expense must be incurred, or, if defended by the Navy, still greater.

I can quite understand the heavy sea that sets in with a south-easterly gale, as mentioned by Captain Powlett, as even in the fine weather we had a slight ground swell set in.

To sum up. As a naval station it is decidedly a very bad one; an indifferent anchorage in many parts. In looking over the Senior Officer's journal I see repeated instances of ships dragging; an anchorage that cannot be made secure from a hostile force except by an extensive system of land forts, which must be widely scattered, consequently necessitating a much larger force to defend it than if it only had one entrance. If command of the sea is lost, it must fall by blockade alone, and the Power possessing the command of the sea can take it at any time if likely to be of use.

The Secretary to the Admiralty to Sir P. Currie.— (*Received November* 11.)

Admiralty, November 10, 1886.

Sir,—I am commanded by my Lords Commissioners of the Admiralty to transmit herewith, for the perusal of the Earl of Iddesleigh, copy of a joint Report which has been received from the officers commanding Her Majesty's ships Leander, Constance, and Linnet, dated the 30th July last, together with a copy of Admiral Hamilton's remarks thereon, respecting the present defenceless state of Port Hamilton, the facility with which shipping there could be destroyed by an enemy's cruiser, and forwarding a plan of the proposed defences of that place.

My Lords are of opinion, that in its present unfortified state Port Hamilton would be a source of weakness to the Naval Commander-in-chief in China in time of war, as it would necessitate the presence of at least two of his vessels to protect it, and that unless it should be decided to fortify and garrison the place—a proceeding which their Lordships do not advocate—it would be better not to retain it.

I am, &c.
(Signed) EVAN MACGREGOR.

In view of possible operations in the North Pacific, Sir Charles Dilke gives other advice more valuable than his recommendations as to the continued occupation of Port Hamilton. China, and England, as he truly says, have identical interests in Asia. They are more closely allied by trade than any other two countries of the world. These considerations point to a permanent alliance. It should be the aim of the Foreign Office to cultivate cordial relations with China.

SECTION II.

BRITISH AND FOREIGN ARMOURED AND UNARMOURED SHIPS.

BRITISH ARMOURED AND UNARMOURED SHIPS.

The list of ships of the British Navy has been compiled from various sources. The official *Navy List* has been the principal guide. As a rule the displacement and indicated horse-power have been given as therein stated. Wherever possible the column under the heading "speed" has been filled up from reports of actual trial. With respect to the gun and torpedo armament, it is to be noted that, owing to the substitution of breech-loaders for muzzle-loaders at present in progress, to the advance in the power of machine-guns, and to the improved methods of ejecting locomotive torpedoes, changes are being continuously made. The columns for "coal-endurance" have been filled, as far as was possible, from the most authentic published reports of the trials of the several ships. Generally the mileage traversible at the speed mentioned has been computed from the quantity of fuel that can be carried in the bunkers. The computations, moreover, have been based upon performances, or estimates of performances, under the most favourable conditions.

The sketches of the ships are all drawn on the same scale (except in a few cases specially indicated), so that their relative sizes are apparent by inspection.

GREAT BRITAIN.—Armoured Ships.

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret-ship; 2 *s.*, two screws.

M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; l., light guns under 15 cwt., including boats' guns; M., machine gun; Q.F., quick-firing gun; *comp.*, compound or steel-faced armour; f. tu., l. car., fixed tube or launching carriage for Whitehead torpedo discharge.

Class.	NAME.	Displacement.	Indicated Horse-Power.	Draught of Water. Extreme.		Length.		Beam.		Where Built.	Maker of Engines.	Date of Completion.	Cost.		Armour.			Backing.	Armament.		Speed.	Coal Endurance.	
													Hull.	Machinery.	Side.	Bulk-head.	Turret.		Guns.	Fish Torpedo Dischargers.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft.	in.	ft.	in.	ft.	in.				£	£	in.	in.	in.	in.			knots.	tons.	knots.
br.	**Achilles** (iron)	9820	5720	27	3	380	0	58	3¼	Chatham	Penn .	1864	375,429	69,117	4½	4½	..	18 to 10	14 12-ton M.L.R., 2 6½-ton do., 14 M., 14 l.	..	14·32	750	2500
t.	**Agamemnon** 2 *s.* (iron)	8510	6360	24	0	280	0	66	0	Chatham	Penn .	1883	402,295	101,770	18 & 15	16½ & 13½	16 & 14	18 to 9	4 38-ton M.L.R., 2 6-in. B.L.R., 6 Q.F., 13 M., 2 l.	2 l. car.	13·25	960	4100
br.	**Agincourt** (iron)	10,690	6870	27	9	400	0	59	5	Birkenh'd	Maudslay .	1868	381,700	83,777	5½	4½	..	10	17 12-ton M.L.R., 15 M., 14 l.	2 l. car.	14·8	750	1300
t.	**Ajax** (iron) 2 *s.*	8510	6440	24	0	280	0	66	0	Pembroke	Penn .	1883	411,622	106,735	18 & 15	16	16	18 to 9	4 38-ton M.L.R., 2 6-in. B.L.R., 6 Q.F., 13 M., 2 l.	2 l. car.	13·25	960	4100
c.b.	**Alexandra** . 2 *s.* (iron)	9490	8610	26	6	325	0	63	8	Chatham	Humphrys	1877	394,263	120,061	12 to 6	8 to 5	..	12 & 10	2 25-ton M.L.R., 10 18-ton do., 6 4-in. B.L.R., 4 Q.F., 15 M., 4 l.	4 l. car.	15·00	680	2700
b.	**Anson** (steel) 2 *s.*	10,000	11,500	27	8	330	0	68	6	Pembroke	Humphrys	Bldg. Lchd. 1886	s 578,696	y 108,720	18 *comp.*	16 *comp.*	barbette 14 & 12 *comp.*	12 to 15	4 67-ton B.L.R., 6 6-in. do., 19 Q.F., 7 M., 2 l.	1 f. tu., 4 l. car.	17·48	1200	7100
c.b.	**Audacious** . 2 *s.* (iron) (Zinc Sheathed)	6010	4830	23	8	280	0	54	0	Glasgow	Ravenhill .	1869	193,863	52,619	8 to 6	5	..	10	10 12-ton M.L.R., 8 4-in. B.L.R., 4 Q.F., 11 M., 9 l.	4 l. car.	13·2	500	1260
a.c.	**Aurora** (steel) 2 *s.*	5000	8500	22	6	300	0	56	0	Pembroke	J. & G. Thomson	Bldg. Lchd. 1887	s 220,550	y 64,000	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. 22-ton B.L.R., 10 6-in. B.L.R., 16 Q.F., 7 M., 2 l.	4 l. car.	18·0	900	8000
a.c.	**Australia** . 2 *s.* (steel)	5000	8476	22	6	300	0	56	0	Glasgow	Napier .	Bldg. Lchd. 1887	196,800	63,000	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. 22-ton B.L.R., 10 6-in. B.L.R., 10 Q.F., 7 M., 2 l.	4 l. car. 2 f. tu.	18·8	900	8000

															tower.		Q.F., 7 M., 2 l.				
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	56 1	Chatham	Penn .	1866	285,788	86,968	6	5	8 pilot tower.	10	10 8-in. 14-ton B.L.R., 4 6-in. do., 6 4-in. do., 4 Q.F., 12 M., 4 l.	2 l. car.	14·17	650	1610
b.	**Benbow** (steel)	2 *s.*	10,600	11,500	28 4	330 0	68 6	Blackwall	Maudslay .	Bldg. Lchd. 1885	^{x}650,820	^{y}110,000	18 *comp.*	16 *comp.*	14 & 12 on barbette *comp.*	12to15	2 111-ton B.L.R., 10 6-in. do., 15 Q.F., 7 M., 2 l.	1 f. tu. 4 l. car.	16·75 By log.	1200	7100
br.	**Black Prince** (iron)	.	9210	5770	26 10	380 2	58 4	Glasgow .	Penn .	1862	283,154	74,482	4½	4½	..	18to10	4 9-ton M.L.R., 22 6½-ton do., 2 6-in. B.L.R., 11 M., 8 l.	2 l. car.	13·60	750	1080
b.	**Camperdown** (steel)	2 *s.*	10,000	11,500	27 3	330 0	68 6	Portsm'th	Maudslay .	Bldg. Lchd. 1886	^{x}578,766	^{y}109,350	18 *comp.*	16 *comp.*	12to14 on barbette *comp.*	10to15	4 67-ton B.L.R., 6 6-in. do., 19 Q.F., 7 M., 2 l.	1 f. tu. 4 l. car.	17·14	1200	7100
b.	**Collingwood** (steel)	2 *s.*	9500	9570	26 10	325 0	68 0	Pembroke	Humphrys	1886	^{x}520,000	^{y}104,000	18 *comp.*	16 *comp.*	12to14 on barbette	17to10	4 45-ton B.L.R., 6 6-in. do., 15 Q.F., 13 M., 2 l.	4 l. car.	16·50	1200	8500
t.	**Colossus** (steel)	2 *s.*	9150	7500	26 3	325 0	68 0	Portsm'th	Maudslay .	1886	533,000	113,786	18 & 14	16 & 13	16 & 14 turret.	22to10	4 45-ton B.L.R., 5 6-in. do., 4 Q.F., 15 M.	2 l. car.	15·50	970	6200
t.	**Conqueror**. (steel)	2 *s.*	6200	6000	24 0	270 0	58 0	Chatham	Humphrys	1882	325,000	93,433	12to8½	11½ to 10½	12 turret & conning tower.	10 to 13½ on sides, 9 on bulkheads.	2 45-ton B.L.R., 4 6-in. do., 6 Q.F., 12 M., 2 l.	6 l. car.	15·50	650	5200
c.s., t.	**Cyclops** (iron)	2 *s.*	3480	1660	16 4	225 0	45 0	Blackwall	Elder .	1871	136,426	17,600	8 & 6	9 & 8 in breastwork.	9 & 10	9 & 11	4 18-ton M.L.R, 4 Q.F., 3 M., 1 l.	..	11·0	250	1920
br.	**Defence** (iron)		6270	2540	26 7	280 0	54 2	Jarrow .	Penn .	1862	197,879	34,357	4½	4½	..	18	2 9-ton M.L.R., 14 6½-ton do., 6 M., 4 l.	..	11·62	450	1100
t.	**Devastation** (iron)	2 *s.*	9330	6650	27 6	285 0	62 3	Portsm'th	Penn .	1873	290,660	63,188	12 & 10	12 & 10 breastwork.	14 & 12	18to16	4 35-ton M.L.R., 6 Q.F., 12 M., 2 l.	2 l. car.	13·84	1800	5980
t.	**Dreadnought** (iron)	2 *s.*	10,820	8210	26 9	320 0	63 10	Pembroke	Humphrys	1875	485,573	107,000	14,12, 11	13	14	18to15	4 38-ton M.L.R., 6 Q.F., 15 M., 2 l.	2 f. tu. 2 l. car.	14·20	1330	5720
t.	**Edinburgh** . (steel)	2 *s.*	9150	7520	26 3	325 0	68 0	Pembroke	Humphrys	1886	^{x}555,333	^{y}87,000	18 & 14	16 & 13	16 & 14	22to10	4 45-ton B.L.R., 5 6-in. do., 7 Q.F., 15 M., 2 l.	2 l. car	15·50	970	6200

x Includes Hydraulic Machinery, Gun Mounting, &c. y Propelling Machinery.

GREAT BRITAIN.—Armoured Ships—*continued.*

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													Hull.	Machinery.	Side.	Bulk-head.	Turret.		Guns.	Fish Torpedo Dischargers.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft.	in.	ft.	in.	ft.	in.			Bldg. l.chd	£	£	in.	in.	in.	in.			knots.	tons.	knots.
a.c.	**Galatea** (steel) 2 *s.*	5000	9205	22	6	300	0	56	0	Glasgow .	Napier	1887	[x] 195,390	[y] 63,000	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. 22-ton B.L.R., 10 6-in. do., 16 Q.F., 7 M., 2 l.	4 l. car. 2 f. tu.	19·01	900	8000
c.s., *t.*	**Glatton** (iron) 2 *s.*	4910	2870	19	5	245	0	54	0	Chatham	Laird .	1872	189,133	30,396	12 to 10	12 breast-work.	14 & 12	20 to 15	2 25-ton M.L.R., 3 Q.F., 4 M., 2 l.	2 sub. f. tu.	12·11	540	2000
c.s., *t.*	**Gorgon** (iron) 2 *s.*	3480	1670	16	4	225	0	45	0	Jarrow	Ravenhill	1872	122,904	15,663	8 & 6	9 & 8 breast-work.	9 & 10	11 to 9	4 18-ton M.L.R., 4 Q.F., 5 M., 2 l.	..	11·14	270	1230
c.s., *t.*	**Hecate** (iron) 2 *s.*	3480	1750	16	4	225	0	45	0	Poplar	Ravenhill	1872	124,906	15,687	8 & 6	9 & 8 breast-work.	9 & 10	11 to 9	4 18-ton M.L.R., 4 Q.F., 4 M., 1 l.	..	10·90	270	1230
br.	**Hector** . (iron)	6710	3260	26	0	280	2	56	5	Glasgow	Napier	1864	237,438	45,764	4½	4½	..	18	2 9-ton M.L.R., 16 6½-in. do. 8 M., 6 l.	..	12·36	460	1460
c.b.	**Hercules** (iron)	8680	6750	26	6	325	0	59	0½	Chatham	Penn	1868	278,320	82,814	9 to 6	6 & 5	..	12 & 10	8 18-ton M.L.R., 2 12½-t. do., 4 7-in. do., 6 4-in. B.L.R., 5 Q.F., 14 M., 4 l.	4 l. car.	14·00	610	1760
t.	**Hero** (steel) 2 *s.*	6200	6000	24	0	270	0	58	0	Chatham	Rennie	1887	[x] 338,971	[y] 58,300	12 *comp.*	11½ *comp.*	12 *comp.*	13½	2 45-ton B.L.R., 4 6-in. do., 12 Q.F., 5 M., 2 l.	6 l. car.	15·5	620	5200
c.s., *t*	**Hotspur** (iron) 2 *s.*	4010	3060	21	10	235	0	50	0	Glasgow .	Napier	1871	135,067	36,461	11 & 8	8 breast-work	10 & 8½	15 to 12 on side 10 on turret	2 25-ton M.L.R., 2 6-in. B.L.R., 4 Q.F., 9 M., 2 l.	2 l. car.	12·8	300	920

																comp.	comp.	11½ to 10 on barbette.	15 to 12	4	67-ton B.L.R., 6 6-in. do., 14 Q.F., 7 M., 2 l.	1 f. tu. 4 l. car.	17·0 forced.	1200	7200
c.s., t.	**Hydra** (iron)	2 s.	3480	1470	16	4	225	0	45	0	Glasgow	Elder	1872	124,454	16,918	8 & 6	9 & 8 on breastwork.	9 & 10	11 to 9	4	18-ton M.L.R., 6 M., 2 l.	..	11·20	250	1920
a.c.	**Immortalité.** (steel)	2 s.	5000	8500	22	6	300	0	56	0	Chatham	Earle	Bldg. Lcbd. 1887	[x] 221,500	[y] 57,000 Estd.	10 comp.	16 comp.	12 conning tower.	6	2	9·2-in. 24-ton B.L.R., 10 6-in. do., 16 Q.F., 7 M., 2 l.	4 l. car.	18·00	900	8000
a.c.	**Impérieuse** . (steel) (Copper sheathed.)	2 s.	8400	10,000	27	4	315	0	62	0	Portsm'th	Maudslay	1886	[x] 417,437	[y] 113,377	10 comp.	9 comp.	8 comp. on barbette.	10	4	9·2-in. 24-ton B.L.R., 6 6-in. do., 8 Q.F., 9 M., 2 l.	2 f. tu. 4 l. car.	16·75	1130	7000
t.	**Inflexible** (iron)	2 s.	11,880	8010	26	4	320	0	75	0	Portsm'th	Elder	1881	648,811	146,457	24, 20, 16	22, 18, 14	17 & 16 comp.	17 to 25	4	80-ton M.L.R., 8·4-in. B.L.R., 6 Q.F., 14 M., 2 l.	2 f. tu. sub. 2 l. car.	13·80	1300	5200
c.b.	**Invincible** . (iron)	2 s.	6010	4830	23	2	280	0	54	0	Glasgow	Napier	1870	187,055	52,386	8 to 6	5	..	10	10	12-ton M.L.R., 6·4-in. B.L., 4 Q.F., 15 M., 4 l.	4 l. car.	14·09	500	1580
c.b.	**Iron Duke** . (iron)	2 s.	6010	3520 forced & reduced boilers.	23	3	280	0	54	0	Pembroke	Ravenhill	1871	146,314	50,165	8 to 6	5	..	10	10	12-ton M.L.R., 6·4-in. B.L.R., 4 Q.F., 14 M., 4 l.	4 l. car.	13·64	700	3900
br.	**Minotaur** (iron)		10,690	6700	27	3	400	0	59	4½	Blackwall	Penn	1867	377,325	79,505	5½	4½	..	10	17	12-ton M.L.R., 14 M., 14 l.	2 l. car.	14·41	750	1200
t.	**Monarch** (iron)		8320	7840	26	7	330	0	57	6	Chatham	Humphrys	1869	279,903	74,672	7 to 6	5 & 4½	10 & 8	12	4	25-ton M.L.R., 2 12-ton M.L.R., 1 6½-ton M.L.R., 4 Q.F., 14 M., 3 l.	2 l. car.	14·94	630	1500
a.c.	**Narcissus** . (steel)	2 s.	5000	8500	22	6	300	0	56	0	Hull	Earle	Bldg. Lcbd. 1887	[x] 195,890	[y] 61,500	10 comp.	16 comp.	12 conning tower.	6	2	9·2-in. 22-ton B.L.R., 10 6-in. B.L.R., 16 Q.F., 7 M., 2 l.	4 l. car. 2 f. tu.	18·00	900	8000
a.c.	**Nelson** (iron) (Zinc sheathed.)	2 s.	7630	6640	26	6	280	0	60	0	Glasgow	Elder	1880	303,310	87,545	9 & 6	9, 8, 6	9 conning tower.	13 to 10	4	18-ton M.L.R., 8 12-ton M.L.R., 6 Q.F., 16 M., 4 l.	2 l. car.	14·41	1150	5200
t.	**Neptune** (iron) (Copper sheathed; was "Independencia.")		9310	8000	26	1	300	0	63	0	Poplar	Penn	1878	600,000 (purchased).		12 to 9	8 & 6	11 & 13	11 to 13	4	38-ton M.L.R., 2 12-ton M.L.R., 14 Q.F., 10 M., 2 l.	2 l. car.	14·20	670	1480

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													Hull.	Machinery.	Side.	Bulk-head.	Turret.		Guns.	Fish Torpedo Dischargers.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft.	in.	ft.	in.	ft.	in.				£	£	in.	in.	in.	in.			knots.	tons.	knots.
t.	**Nile** (steel) 2 *s.*	11,940	12,000	27	6	345	0	73	0	Pembroke	Maudslay	Bldg.	^{x} 765,794	^{y} 98,000	20 to 16	18 to 14	18	6	4 67-ton B.L.R., 8 5-in. do., 18 Q.F., 4 M.	6 f. tu. 2 l. car.	16·50	1200	6500
a.c.	**Northampton** 2 *s.* (iron) (Zinc sheathed.)	7630	6070	25	9	280	0	60	0	Glasgow	Penn	1878	296,836	98,968	9 & 6	9, 8, 6	9 conning tower.	13, 10	4 18-ton M.L.R., 8 12-ton M.L.R., 14 Q.F., 8 M., 3 l.	2 l. car.	13·20	1150	3850
br.	**Northumberland** (iron)	10,780	6560	27	1	400	4	59	5	Millwall	Penn	1868	391,481	79,871	5½	4½	5½ conning tower.	10	7 12-ton M.L.R., 20 9-ton do., 11 M., 16 l.	4 l. car.	14·13	756	1270
c.b.	**Orion** (iron) 2 *s.* (was "Boordji-Zaffer")	4870	4040	21	4	245	0	52	0	Poplar	Maudslay	1882	239,270	52,959	12, 10, 8, 7	9, 6, 5	9 conning tower.	16 & 9	4 25-ton M.L.R., 6 Q.F., 8 M., 2 l.	4 l. car.	13·0	520	1830
a.c.	**Orlando** (steel) 2 *s.*	5000	8622	22	6	300	0	56	0	Jarrow	Palmer	Bl'g. Lchd 1887	^{x} 206,647	^{y} 60,165	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2 in. 22-ton B.L.R., 10 6-in. do., 16 Q.F., 7 M., 2 l.	4 l. car. 2 f. tu.	19·25	900	8000
c.b.	**Penelope** (iron) 2 *s.*	4470	4700	17	6	260	0	50	0	Pembroke	Maudslay	1868	145,998	40,855	6 & 5	4½	..	10 & 11	8 9-ton M.L.R., 3 40-pdrs., B.L.R., 8 M., 6 l.	..	12·76	470	1360
c.s., *t.*	**Prince Albert** (iron)	3880	2130	20	4	240	0	48	1	Poplar	Humphrys	1866	178,537	24,129	4½	..	10 & 5½	18	4 12-ton M.L.R., 6 M., 2 l.	..	11·65	230	980
c.b.	**Repulse** (wood)	6190	3350	26	2	252	0	57	1½	Woolwich	Penn	1870	156,246	27,304	6	4½	..	31	12 9-ton M.L.R., 8 M., 9 l.	2 l. car.	12·28	500	1700
b.	**Rodney** (steel) 2 *s.*	9700	11,500	27	[illegible]	325	0	68	0	Chatham	Humphrys	1887	^{x} [illegible]	^{y} 105,400	18 *comp.*	16 *comp.*	11½ to 10 on barbettes	15 to 12	4 67-ton B.L.R., 6 6-in. do., 12 Q.F., 18 M., 9 l.	4 l. car.	17·0	1200	8500

										Chatham	Napier	1874	103,171	30,506	11 & 9	12 breastwork.	14 & 12	14 & 10	2 18-ton M.L.R., 2 6-in. B.L.R., 4 Q.F., 8 M., 2 l.	4 l. car.	13·59	480	1840
t.	**Sans Pareil** . 2 s. (steel)	10,470	12,000	27	3	340	0	70	0	Blackwall	Humphrys	Bldg Lcbd. 1887	^{x} 609,109	^{y} 110,838	16 to 18 *comp.*	16	18 *comp.*	6	2 111-ton B.L.R., 1 10-in. 29-ton do., 12 6-in. 5-ton do., 21 Q.F., 8 M.	6 f. tu. 2 l. car.	16·75	1200	7000
c.t., t.	**Scorpion** (iron)	2750	1450	16	11	224	0	42	4½	Birkenh'd	Laird	1865	92,033	18,540	4½	..	5	10 to 8	4 12-ton M.L.R., 6 M., 1 l.	..	10·51	320	1210
a.c.	**Shannon** (iron) (Zinc sheathed.)	5390	3370	23	4	260	0	54	0	Pembroke	Laird	1877	233,902	58,367	9, 8, 6	9 & 8	9 conning tower.	10 & 12	2 18-ton M.L.R., 7 12-ton M.L.R., 10 M., 8 l.	2 l. car.	12·35	580	2260
c.b.	**Sultan** . (iron)	9200	7720	27	6	325	0	59	0½	Chatham	Penn	1871	281,373	76,042	9, 8, 6	6 to 4½	..	12 & 10	8 18-ton M.L.R., 4 12½-ton M.L.R., 7 4-in. B.L.R., 4 Q.F., 13 M., 4 l.	4 l. car.	14·13	810	2140
c.b.	**Superb** .. (iron) (was "Hamidyeh")	9170	6580	26	5	332	3	59	0	Blackwall	Maudslay	1880	443,000 (purchased)		12,10,7	10,7,6 5	8 on conning tower.	7 to 12	16 18-ton M.L.R., 6 4-in. B.L., 10 Q.F., 12 M., 3 l.	4 l. car.	13·50	970	1810
c.b.	**Swiftsure** (iron) (Copper sheathed.)	6910	4970	26	0	280	0	55	0	Jarrow	Maudslay	1872	207,940	49,141	8 to 6	6, 5, 4	..	10	10 12-ton M.L.R., 8 4-in. B.L., 4 Q.F., 15 M., 7 l.	4 l. car.	13·75	540	1630
c.b. & b.	**Temeraire** . 2 s. (iron) (Zinc sheathed)	8540	7520	27	2	285	0	62	0	Chatham	Humphrys	1877	352,015	102,954	11, 10, 9, 8	8—5	10 fore 8 after barbette	12 & 10	4 25-ton M.L.R., 4 18-ton do., 6 4-in. B.L.R., 6 Q.F., 15 M., 3 l.	2 l. car.	14·50	620	2680
t.	**Thunderer** . 2 s. (iron)	9330	6270	27	0	285	0	62	3	Pembroke	Humphrys	1877	306,084	52,458	12 & 10	12 & 10 breastwork.	14 & 12	18 to 16	2 38-ton M.L.R., 2 35-ton do., 6 Q.F., 12 M., 2 l.	2 l. car.	13·40	1600	3040
t.	**Trafalgar** . 2 s. (steel)	11,940	12,000	27	6	345	0	73	0	Portsm'th	Humphrys	Bldg. Lcbd 1887	^{x} 765,794	^{y} 97,000	20 to 16	18 to 14	18	6	4 67-ton B.L.R., 8 5 in. do., 18 Q.F., 4 M.	6 f. tu. 2 l. car.	16·50	1200	6500
c.b.	**Triumph** . (iron) (Copper sheathed.)	6640	5110	26	2	280	0	55	0	Jarrow	Maudslay	1873	209,109	49,213	8 to 6	6, 5, 4	..	10	10 12-ton M.L.R., 4 5-in. B.L.R., 4 Q.F., 12 M., 10 l.	4 l. car.	13·75	550	1680
a.c.	**Undaunted** 2 s. (steel)	5000	9020	22	6	300	0	56	0	Jarrow	Palmer Co.	Bldg Lcbd. 1887	^{x} 195,890	^{y} 60,165	10 *comp.*	16 *comp.*	12 conning tower.	6	2 9·2-in. 22-ton B.L.R., 10 6-in. do., 16 Q.F., 7 M., 2 l.	4 l. car. 2 f. tu.	19·4	900	8000

x Includes Hydraulic Machinery, Gun Mountings, &c. y Propelling Machinery.

GREAT BRITAIN.—Armoured Ships—*continued.*

a.c., armoured cruiser; *a.g.b.*, armoured gun boat; *b.*, barbette ship; *br.*, broadside ship; *c.b.*, central battery ship; *c.s.*, coast-service vessel *t.*, turret-ship; 2 *s.*, two screws.

M.L.R., muzzle-loading rifled gun: B.L.R., breech-loading rifled gun; l., light guns under 15 cwt., including boats' guns; M., machine gun; Q.F., quick-firing gun; *comp.*, compound or steel-faced armour; f. tu., l. car., fixed tube or launching carriage for Whitehead torpedo discharge.

Class.	NAME.	Displacement.	Indicated Horse-Power.	Draught of Water. Extreme.		Length.		Beam.		Where Built.	Maker of Engines.	Date of Completion.	Cost.		Armour			Backing.	Armament.		Speed.	Coal Endurance.	
													Hull.	Machinery.	Side.	Bulk-head.	Turret.		Guns.	Fish Torpedo Dischargers.		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
		tons.		ft.	in.	ft.	in.	ft.	in.				£	£	in.	in.	in.	in.			knots.	tons.	knots.
br.	**Valiant** . (iron)	6710	3350	26	8	280	2	56	4	Poplar	Maudslay	1865	271,964	48,324	4½	4½	..	18	2 9-ton M.L.R., 16 6½-ton do., 8 M., 4 l.	..	12·65	450	1430
t.	**Victoria** (steel) 2 *s.* (was "Renown").	10,470	12,000	27	8	340	0	70	0	Newcastle	Humphrys	Bldg. l.chd. 1887	612,522	112,333	16 to 18 *comp.*	16	18 *comp.*	6	2 111-ton B.L.R., 1 29-ton do., 12 6-in. 5-ton do., 21 Q.F., 8 M.	6 f. tu. 2 l. car.	16·75	1200	7000
a.g. b.	**Viper** (iron) 2 *s.*	1230	700	11	8	160	0	32	0	Poplar	Maudslay	1867	43,517	7,610	4½	4½	..	10	2 6½-ton M.L.R., 2 l.	..	9·59	110	—
a.g. b.	**Vixen** . . 2 *s.* (Composite.)	1230	740	11	8	160	0	32	5	Deptford Green	Maudslay	1866	46,333	7,860	4½	4½	..	10	2 6½-ton M.L.R., 2 l.	..	8·89	110	—
br.	**Warrior** . (iron)	9210	5270	26	9	380	2	58	4	Blackwall	Penn	1861	282,284	74,409	4½	4½	..	18 to 10	4 9-ton M.L.R., 28 6½ do., 8 M., 4 l.	..	14·40	790	1210
a.c.	**Warspite** . 2 *s.* (Copper sheathed.)	8400	10,000	27	4	315	0	62	0	Chatham	Penn	1886	[x] 415,546	[y] 113,786	10 *comp.*	9 *comp.*	8 barbette.	10	4 9·2 in. 24-ton B.L.R., 6 6-in. do., 6 Q.F., 14 M., 3 l.	2 f. tu. 4 l. car.	16·75	1130	7000
c.s., t.	**Wivern** . (iron)	2750	1450	17	0	224	6	42	4	Birkenh'd	Laird	1865	98,118	18,390	4½	..	5	8 to 10	4 12-ton M.L.R., 8 M., 1 l.	..	10·06	300	1150
The following do not appear in the Official Navy List:—																On breast-work.							
c.s., t.	**Abyssinia*** (iron) 2 *s.* (*Indian Marine*)	2900	950	14	6	225	0	42	0	Poplar	Dudgeon	1870	97,049	19,500	7 & 6	8 & 7	10 & 8	11 to 9	4 18-ton M.L.R., 2 M., 2 l.	..	9·59	92	—
c.s., t.	**Cerberus**† (iron) 2 *s.* (*Colonial Marine*)	3480	1370	15	8	225	0	45	0	Jarrow	Maudslay	1870	99,831	18,225	8 to 6	Do. 9 to 8	10 & 9	11 to 9	4 18-ton M.L.R., 4 M., 2 l.	..	9·75	120	—
c.s., t.	**Magdala**‡ (iron) 2 *s.*	[illegible]	1440	15	8	[illegible]	0	45	0	Blackwall	Ravenhill	1870	115,400	17,000	8 to 6	Do. 9 to 8	10 & 9	11 to 9	4 18-ton M.L.R., 4 M.	..	10·67	120	—

The names of the following armoured ships do not now appear in the Navy List, the ships having been disposed of by sale or otherwise:—

Cruisers.		Tons Displacement.	I.HP.
Caledonia	(wood)	6,830	4,540
Enterprise	,,	1,350	690
Favorite	,,	3,230	1,770
Lord Clyde	,,	7,840	6,064
Lord Warden	,,	7,840	6,700
Pallas	,,	3,790	3,580
Research	,,	1,740	1,040
Resistance (used as a torpedo target ship).	(iron)	6,270	2,430
Royal Alfred	(wood)	6,700	3,430
Royal Oak	,,	6,730	3,700
Waterwitch (hydraulic propeller)	(iron)	1,280	780
Zealous	(wood)	6,100	3,450

No new armoured ship will be laid down for the British Government either in the Royal Dockyards or at contractors' premises during the year 1887, and according to the latest official utterance of the First Lord of the Admiralty, no armoured ship will in the future be built for this country unless the condition of armoured shipbuilding in other countries renders that course necessary.

DETAILS OF CONSTRUCTION AND TRIALS OF RECENT SHIPS.*

THE TRAFALGAR AND NILE.

The Trafalgar and Nile.

In last year's *Naval Annual* we gave a description of these ships on page 185. This year we record the fact that the Trafalgar was launched at Portsmouth on 21st September, 1887, and add that the Nile will be launched at Pembroke early in the summer of 1888.

The following official particulars of these two ships are in greater detail than we have given before.

The ships are 345 ft. long between the perpendiculars, and 73 ft. broad. The load draught of water will be 27 ft. forward and 28 ft. aft when fully equipped for sea, and the displacement tonnage

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* These notes have been taken generally from articles in English and foreign journals. As they have all undergone editorial modification by way of correction, extension or abridgment, the sources are not acknowledged in detail.

The Trafalgar and Nile.

is 11,940. The normal coal stowage is 900 tons, which is carried in fore and aft bunkers, extending from the fore end of her double bottom to the after end of engine room.

The armament is to consist of four 13½ in. 67-ton breech-loading rifled guns, eight 5 in. breech-loading guns, or six 36-pounder quick-firing guns; eight 6-pounder and ten 3-pounder Hotchkiss quick-firing guns; machine, boat, and field guns, and eight Whitehead torpedo dischargers, four below water-line, and four above it. The turret guns fire a projectile weighing 1250 lb., with a powder charge of 630 lb., and train through an angle of 270 deg. The eight 5-in. guns, or the six 36-pounder quick-firing guns, will be mounted on the upper deck between the turrets, and will be protected on the sides of the ship from rifle fire by two thicknesses of ½-in. plating, and at each end of the battery by an armour bulkhead 5 in. thick, fitted upon 6 in. of backing and an inner skin. These guns will train through 60 deg. on each side of the beam.

The eight 6-pounder Hotchkiss guns will all be fought from the spar deck, but the 3-pounder guns will be distributed between the spar deck, bridge, stern ports, and military tops. There are eight torpedo tubes, four above and four below water. The latter are fixed tubes. Of the above-water tubes, which are on the main deck, one at the bow and one at the stern are fixed; the others, one on each side at fore end of citadel, are trained to fire 70 deg. before and 10 deg. abaft the beam. The whole of the above-water tubes are protected from machine gun-fire by 2-in. plating.

The vessels are fitted with twin screws, each to be driven by an independent set of triple expansion engines, with three vertical cylinders of the collective power of 6000 horses for each set. The weight of this machinery is 1030 tons. The crank and propeller shafts are hollow, and made of compressed steel. The diameter of the screw propellers will be about 16 ft.

The boilers are six in number and of cylindrical form, the shells being of Siemens-Martin's steel and the furnaces corrugated.

Fans driven by steam power are fitted for supplying forced draught to the boiler rooms, and the engines are, when forced draught is used, expected to develop a full power of 12,000 indicated horses, which must be maintained at the official trial of the machinery for four consecutive hours. With this power a speed of 16½ knots is anticipated.

The steaming distance of the ships under full power is 1050 knots and at 10-knots speed 6500 knots.

With the stokeholds not under forced draught the anticipated

The Trafalgar and Nile.

power of engines is 7500 horses, which must be maintained at the official trial for four consecutive hours.

The structural details are in some respects novel, particularly in the construction of the armoured side and turrets.

The construction of side behind the thick armour consists of two thicknesses of skin, the outer of 60 lb. and the inner of 30 lb. per square foot, riveted to plate and angle frames 2 ft. deep and 2 ft. apart. On the inside of these frames plating of 20 lb. per square foot is worked, and the belt and citadel armour bolts are hove up between them on the inner end of a cast steel sleeve about 12 in. long. Within these frames and behind the belt armour only is a second system of lightened plate frames, 3 ft. deep and 4 ft. apart, on the inside of which the outer bulkhead of the coal bunkers is riveted. The strength of the armoured side is thus exceptionally great.

The engine and boiler rooms are divided at the middle line of the ship by a water-tight tunnel 10 ft. 6 in. wide. The upper part of the tunnel forms a passage for communication between the ends of the ship, and also for the passage of ammunition through the deck above for the auxiliary armament; the lower part forms the main magazines and shell rooms of the ship.

The only other ships in existence having these arrangements are the Victoria and Sans Pareil, for which they were devised by the late Council of Construction.

They have a ram bow. The stem, which is of cast steel, is strengthened in wake of the projecting portion under water by a horizontal prow consisting of two 5-in. armour plates. They have an armoured belt 230 ft. long, surmounted by an armoured citadel 141 ft. long at the sides of the ship, these structures being bounded by armoured bulkheads, those of the citadel being curved. The length from end to end of the citadel is 193 ft. At the end of the citadel and within the limits of the armoured belt the turrets are placed, the extension of the belt at each end beyond the ends of the citadel forming a protection to the substructure and machinery of the turrets.

The whole of the armour on belt, citadel, turrets, and conning tower is steel faced. The side armour varies in thickness on the belt from 20 in. to 16 in., tapering at the lower edge from 8 in. to 6 in. The boundary bulkheads to belt are armoured with 16-in. and 14-in. plates, tapering at the lower part to 7 in.

The citadel armour varies from 18 in. to 16 in. Above the citadel transverse armour screens are fitted 5-in. thick, protecting the 5-in. guns from raking fire. The turret framing is constructed similarly to

The Trafalgar and Nile.

the armoured side of the ship, the armour being 18 in. thick. The total thickness of wall is 4 ft. for armoured citadel, belt, and turrets, and 5 ft. for the armoured ends of belt.

The ships are well subdivided into water-tight compartments, as follows:—In the double bottom 40, below the protective deck and before the double bottom 13, abaft it 18, and in hold in wake of the double bottom 49, including eight divisions in the coal bunkers, or a total of 120 water-tight compartments below the protective deck. On this deck before and abaft the armoured citadel there are 14 such compartments. These are in wake of the waterline, and being filled with stores would give buoyancy to the relatively very small unarmoured ends of the ship when riddled.

The ship will be controlled in action from a pilot tower, protected by 14 inches of armour, which stands upon the spar deck, and will be fitted with steering wheels and telegraphs, voice pipes to the various steering wheels, engine-rooms, guns, and torpedo-tubes, and also with gun and torpedo directors, which will enable the officer in the tower to direct the training of the turret guns, and also of the 5-in. guns, on any object, and to fire them simultaneously.

In addition to this tower there will be two side conning towers protected from machine-gun fire; and from these positions also the ship may be steered, and the turret guns fired.

The upper deck over the citadel is plated with two thicknesses of steel plating each weighing 60 lb. per square foot, while the main deck between the ends of the armoured belt and ends of citadel is covered with plating of the same thickness. This protective plating is continued to the extremities of the ship on the lower deck beyond the limits of the armoured belt.

They will be fitted to steer both by hand and steam, the steam-steering engine being a double cylinder direct-acting one, and of sufficient power to put the helm from hard-a-port to hard-a-starboard, and *vice versâ*, or through an angle of 70 deg. in 30 seconds when the vessel is proceeding at full speed.

The steam-steering gear can be controlled from the armoured pilot tower, the chart-house on the bridge, the side conning towers, or, in the event of the pilot tower gear being disabled, from a protected position on the platform deck directly below the tower. The hand-steering wheel is fitted under the protective deck and close to the steering engines.

Electricity will play an important part in the ships' economy, as they will be lighted throughout with over 460 incandescent lamps each, and will be fitted with four search lights in side towers, two on the

The Trafalgar and Nile.

spar deck and two on the main deck. The turret guns and auxiliary armament of 5-in. breech-loading or 36-pounder quick-firing guns, will also be electrically discharged. For these purposes they will have three powerful dynamos of 400 ampères each.

The arrangements for freeing the ships from water are very complete. This may be done either by hand or steam power, Downton's pumps being used for hand, and the circulating pumps in engine room, as well as the bilge-pump donkey engines, for steam power.

In each engine-room two main circulating pumps and two engines will be fitted, each large enough for full power working, and these can be used also for pumping out the bilges of the ship in the event of a leak. Each of these circulating pump engines will be powerful enough to discharge 1000 tons of water from the bilge per hour. In each engine-room there will also be fitted a steam-pumping engine, adapted as a fire engine, and two similar auxiliary engines for pumping out the ship and boilers and washing decks, &c.

A complete system of ventilation is adopted for the ship, combining natural with artificial ventilation, the former being resorted to as far as possible; but the principal compartments at the extremities of the ship below the protective deck, and also the living spaces above it, are supplied with a forced current of air, and corresponding means of exhaust.

The weight of the Trafalgar as launched was about 5400 tons, and including the weight of the bilgeways, poppets, and other gear for launching her, the total weight upon the groundways was over 5700 tons.

The pressure per square foot upon the groundways was about 2·9 tons.

VICTORIA.

The Victoria.

On the 9th April, 1887, the armourclad war-ship Victoria was launched from the Elswick yard of Sir W. G. Armstrong, Mitchell & Co., Newcastle-on-Tyne, by whom she has been built for the British Government. Originally it was intended that the vessel should be named the Renown, but this was afterwards altered, and the name Victoria given to her instead, in honour of the Queen's jubilee. The Victoria forms part of the 25,000 tons of new shipping for which the orders were given out in 1885. Two new ironclads and five belted cruisers were at that time ordered from private firms. The Elswick Company obtained the contract for one ironclad, and the Thames Shipbuilding Company for the other. The first rivet in the Victoria was driven by Sir William Armstrong in June 1885, so that

The Victoria.

she was nearly two years on the building slip, and nearly a similar period will have to elapse before she is ready for delivery. She will then, however, be well advanced, the firm which has built the vessel also providing her with all her armaments and machinery; this, we believe, being the first instance in which a war-ship has been built and made ready for the reception of her crew by a single firm. The Victoria is one of the largest ironclads in the British Navy. Her dimensions are—length, 340 ft.; breadth, 70 ft.; mean draught, 25 ft. 9 in.; displacement in tons, 10,470; horse-power, 12,000. She is protected by armour 18 in. thick, and is armed with two 111-ton guns, one 29-ton gun, twelve 6-inch 5-ton guns, twelve 6-pounder quick-firing guns, nine 3-pounder quick-firing guns, besides eight machine-guns for smaller ammunition. She also has a powerful ram, and eight torpedo dischargers, four below the water-line and four above it. The Victoria is the heaviest vessel ever launched on the Tyne.

SANS PAREIL.

The Sans Pareil.

On the 9th May, 1887, the Sans Pareil was launched from the yard of the Thames Ironworks and Shipbuilding Company. The launch took place shortly after 2 P.M. The ceremony was performed by Lady George Hamilton.

The Sans Pareil is a sister ship of the Victoria, recently launched by Messrs. Armstrong, Mitchell & Co., at Newcastle. The engines are by Messrs. Humphrys, Tennant and Co., and are expected to develop 7500 indicated horse-power with natural draught, and 12,000 indicated horse-power with forced draught. A speed of 16¾ knots is expected. The armament is precisely the same as described above for Victoria. The Sans Pareil, as well as her sister, has 170 water-tight compartments, necessitating the introduction of 969 water-tight doors, scuttles, and valves; while the steam-engines, main and auxiliary, amount to fifty-five in number. The contract for this vessel was taken on April 21, 1885, and the first keel-plate was laid on June 26 of the same year. The dead weight of the Sans Pareil is stated to be 6000 tons. The original contract price was £504,000 for the hull, and £97,000 for the propelling machinery, making a total of £601,000. But before any progress was made in the construction of the ship, certain changes were introduced in the plan of the upper works, and the contract now appears as £537,444 for the hull, and £111,018 for the propelling machinery, thus raising the total to £648,462. The estimate for the gun mountings and torpedo gear remains unaltered, being £55,636 for the former, The Sans Pareil.

and £10,980 for the latter. Fittings and equipment, in the shape of dockyard work, will absorb £40,000 more, making the total estimated cost under the Navy votes £755,078. The estimated expenditure for guns and other matters, chargeable to the Army votes, is £70,390, making the total cost of the ship, when fully armed and equipped, £825,468. The total estimated cost for the Victoria is £829,979. The contract was taken while the Benbow was on the stocks, consequently the keel could not be laid until two months after the signing of contract; but the interval gave time for the preparation of a large amount of material ready to be placed on the blocks as soon as they were ready, and on the 26th day of June the first keel plate was laid and since that time the material has been worked into the vessel at the rate of 260 tons per month. This is not a large amount compared with merchant vessel construction; but when it is remembered that the hull of an armourclad is composed of a multitude of small water-tight compartments, with numerous water-tight doors, armour-decks, armour-plates, and backing, all demanding care and skill, occupying time not necessary in merchant vessel construction, the amount is large. At first the amount that can be worked in is small, but as the framing of the vessel expands, a large number of hands can be set to work, so that in some weeks as much as 100 tons has been put into place. The result is that on the day of the launch upwards of 6000 tons dead weight of steel material, armour-plates, teak backing, decks, smithings, &c., were set in motion down the ways into the Thames, the greatest weight launched in this country since the launch of the Great Eastern.

ANSON.

The Anson.

The last of the ships of the Admiral class, the Anson, which was taken round from Pembroke (where she was built) to Portsmouth, to receive her armament and torpedo fittings, and prepare generally for sea, completed her official engine trials in the Solent on April 6th, 1887. The Anson is similar to the Benbow, described in *The Naval Annual* for 1886, page 166, except in regard to the armament. The latter ship has one 111-ton gun in each of her two barbettes, and ten 6-inch 5-ton guns in her auxiliary battery. The Anson has two 67-ton guns in each of her two barbettes, and six 6-inch 5-ton guns in her auxiliary battery. The Anson is fitted with twin-screw vertical compound engines of 9500 indicated horse-power by Messrs. Humphrys, Tennant & Co. In

The Anson.

design they are similar to the engines supplied by the same firm to the Howe, Rodney, and Collingwood, belonging to the same class of battle-ships. Each set of engines has one high-pressure cylinder, 52 in. in diameter, placed between two low-pressure cylinders, 74 in. in diameter, the stroke being 3 ft. 9 in. The surface condensers contain an ample amount of cooling surface. The air-pumps are worked direct off the low-pressure cylinders, and are made entirely of gun-metal. The slide valves are actuated by link motion on Messrs. Humphrys' usual plan. The crank-shafts are of hollow steel, made in three interchangeable lengths, while the frames for carrying them are made of cast steel, bolted on to box girders, which are built into and form part of the structure of the hull. This is an excellent arrangement, and saves a great deal of weight. The whole of the propeller shafting is made of Whitworth's hollow fluid-compressed steel. Gun-metal centrifugal pumps with separate engines are provided for circulating the water through the condensers, and an additional condenser of the same material has been fitted for condensing the steam used by the whole of the auxiliary engines throughout the ship. This condenser is provided with a separate circulating engine and centrifugal pump, so as to be quite independent of the main propelling machinery. For the first time in a ship of war steam is generated in the Anson in eight four-furnace boilers, made entirely of Siemens-Martin steel. They are fitted with 3408 tubes, 2¼ in. in diameter and 7 ft. long, and possess a collective area of firegrate of 756 square feet. The boilers are placed in four separate stokeholds, and are furnished with independent donkey pumps, &c., so as to render them entirely under the control of the stokehold staff. The forced draught fans are fixed in convenient and accessible positions, and are driven by Brotherhood's small three-cylinder engines. The propellers have a diameter of 17 ft. 6 in. and a pitch of 19 ft. 6 in. The weight allowed by Admiralty contract for boilers, engines, and fittings amounted to 1225 tons, but, as a matter of fact, the weight actually on board does not amount to more than 1150 tons, so that there has been a saving of 75 tons.

The full-power trial with natural draught was made on April 4th in very favourable circumstances as regards weather. As an illustration of the ease with which the leading marine engineers of the country can undertake the movement of these stupendous masses of inert matter—the Anson is of 10,000 tons displacement—and the confidence with which they can foresee results, though dependent upon the harmonious working of a prodigious number of reciproca-

The Anson.

tions, it may be mentioned that the contractors in this case dispensed with the usual formal preliminary trial for the testing of bearings, and began the trial right away, after a short canter to sea for the purpose of getting up steam. The confidence was, moreover, amply justified by events, since no mishap of any kind occurred throughout the day, and the power developed was obtained without difficulty. It is only in the engining of small craft or ships of comparatively small displacement that repeated breakdowns of machinery have to be recorded. The trim of the Anson on the occasion was 22 ft. 6 in. forward and 24 ft. 2 in. aft, giving a mean draught of 23 ft. 4 in., or 3 ft. 5 in. less than her designed load-line. The natural-draught trials of our first-class battle-ships have now lost much of their interest, for although the Admiralty insist upon a certain minimum of power being developed during the run—in this particular instance amounting to 7500 horses—yet, as the contract test is invariably reached with ease, the trial becomes mere child's-play in skilful hands. At the end of the trial the following mean results were recorded:—Steam in boilers, 94 lbs.; vacuum, 28 in. and 29 in.; revolutions, 97; and indicated horse-power, 8320. Though greatly in excess of the specification, the power developed might readily have been increased had there been any necessity for it. One observation, taken when the engines were working at their best, showed that 9000 horses had been developed, so that had the two first half-hours been thrown out, and the trial prolonged, the augmentation in the mean power indicated would have been considerable. But this was not deemed necessary, or even desirable, and the trial was brought to an end at the stated time. The speed of the ship, as tested upon the measured mile, was 16½ knots, the consumption of fuel during the entire run being equal to 2·3 lbs. per horse per hour. On the termination of the trial the turning powers of the ship were tested with both engines going ahead. The port half-circle was turned in 2 min. 28 sec., and the complete circle in 5 min. 15 sec.; while the starboard half-circle was turned in 2 min. 46 sec., and the complete circle in 5 min. 47 sec., the diameters being 640 and 650 yards respectively. The time required to get the helm hard over, 34½ deg. to starboard and 34½ deg. to port, was 27 sec.

The important and crucial trial under forced draught came off on April 6th, with results which may be described as unique. The day was exceedingly rough. The wind blew from the north-east with the force of from 8 to 9—a moderate gale—the sea being lumpy and flecked in all directions with "white horses." The course in conse-

The Anson.

quence was confined between the Warner Lightship and Cowes, cascades of spray breaking over the weather bow as the armourclad swept down channel without perceptible lifting under the pressure of the water. Just as the first half-hour had been completed, and a collective power of 12,466·77 horses had been indicated, with 108 revolutions of the engines, a little dirt was forced into the low-pressure eccentric of the port engine, which caused it to heat. The engines were at once eased and a spare rod was substituted, and such was the accuracy of the workmanship that the engines were again started and driven at full speed and the trial completed without a hitch occurring, the following being the results of the half-hourly observations:—

Revolutions.		Mean Pressures.				Collective Power.
S.	P.	H. Starboard L.		H. Port L.		
108·3	107·9	58·2	16·0	58·2	14·5	12,533·38
108·6	108·9	61·0	16·6	59·0	14·4	12,890·37
109·0	109·0	57·4	16·0	57·6	15·0	12,655·88
108·4	109·0	55·5	15·1	57·6	14·35	12,198·59
109·2	109·5	57·8	16·4	59·5	14·75	12,853·22
107·9	109·0	59·0	15·7	58·5	14·7	12,594·53
108·6	109·6	57·4	15·4	57·4	14·65	12,458·77
108·9	108·3	55·0	15·3	58·0	14·95	12,357·51

The new type of boilers worked very satisfactorily. They save weight and stokehold space, and are constructed to blow off at a pressure of 100 lbs. to the square inch. Although the air-pressure never exceeded 2 in., the steam was blowing off through the safety-valves during the whole trial, so much so that near the end the pressure was slightly reduced. The means recorded were:—Steam in boilers, 101 lbs. vacuum—starboard, 28 in.; port, 28 in. Revolutions—starboard, 108·6; port, 108·9. Mean pressures—starboard, high, 57·66; low, 15·81; port, high, 58·22; low, 14·66. Indicated horse-power—starboard, high, 3023·6; low, 3359·8; port, high, 3060·9; low, 3123·3. Collective indicated horse-power, 12,567·78. Consumption per hour per horse, 2·2 lbs. The power developed was thus not only greater than by any ship of the Admiral class, but is considerably greater than at the trial of any ship in H.M. service, being not less than 3068 horses beyond the contract, and at an expenditure of fuel not greater than with natural draught. In the course of the four hours' trial five runs were made on the measured mile, the result giving a mean speed of 17·435 knots an hour.

The Anson.

As the Anson is the last of the class, we append the performances of the whole of the Admirals:—

Ship.	Natural Draught.	Forced Draught.
COLLINGWOOD:—		
Indicated Horse-power	8,099·84	9,573·0
Speed		16·844
HOWE:—		
Indicated Horse-power	7,733·42	11,728·8
Speed		16·936
RODNEY:—		
Indicated Horse-power	8,259·0	11,156·0
Speed		16·9
BENBOW:—		
Indicated Horse-power	8,658·0	10,860·0
Speed		17·5 (by log)
CAMPERDOWN:—		
Indicated Horse-power	8,605·96	11,740 88
Speed		17·144
ANSON:—		
Indicated Horse-power	8,319·12	12,567·78
Speed		17·435

It is to be noted that while the other ships on the list use steam at 90 lbs. pressure, the Anson takes it at 100 lbs. pressure. But in her case the number of boilers is reduced from twelve to eight. It is necessary, in order to explain the apparent anomalies in the tabular statement of results as regards differences of speed, to point out that the important factor of draught requires to be taken into consideration. The Howe, for instance, with greater indicated horse-power than the Benbow, is represented as realising nearly a knot less speed. The discrepancy was due to the fact that the Howe was tried on the measured mile at her load-line, whereas the Benbow was tried in a light condition and her speed was measured by patent log.

THE IMPÉRIEUSE AND WARSPITE.

The Impérieuse and Warspite.

During the year 1887 exaggerated statements appeared in some of the newspapers and elsewhere with reference to the excess in actual draught of water of the Impérieuse and Warspite.

The following statements of the difference in actual draught from that

The Impérieuse and Warspite.

designed and of the alterations made during the time the Impérieuse was in course of construction, which caused the difference, are taken from a Parliamentary Paper published during the Session of 1887. These statements give the actual facts:—

IMPÉRIEUSE.

—	As Designed.	As Completed for Trial Cruise, August, 1886.	When Complete, after Removal of Masts (Estimated), December, 1886.
	Ft. Ins.	Ft. Ins.	Ft. Ins.
Length between perpendiculars	315 0	315 0	315 0
Breadth extreme	62 0[1]	62 0	62 0
Load draught of water — Forward	24 5	26 6	26 3½
Load draught of water — Aft	25 5	27 6	27 3½
Load draught of water — Mean	24 11	27 0	26 9½
Displacement (tons) . . .	7,600[1]	8,500	8,400
Indicated horse-power of engines	8,000	10,000[2]	10,000[2]
Full speed (knots per hour) .	16	16¾[2]	16¾[2]
	Ft. Ins.	Ft. Ins.	Ft. Ins.
Height of armour above load water-line.	3 3	1 2	1 4½
Depth of armour below load water-line.	4 9	6 10	6 7½
Coals — Complement at above load draught (tons) .	400	900[3]	900[3]
Coals — Corresponding radius of action at 10 knots .	2,450 knots	5,500 knots	5,500 knots
Coals — Capacity of bunkers (tons)	900	1,130	1,130
	No.	No.	No.
Armament	4 9·2-in. (18-ton) guns 6 6-in. (4½-ton) guns 10 Nordenfelt guns 12 Whitehead torpedoes Boat and field guns, &c.	4 9·2-in. (24-ton) guns)[4] 6 6-in. (5-ton) guns[4] 10 Nordenfelt guns 18 Whitehead torpedoes Boat and field guns, &c. 4 6-pr. quick-firing guns	4 9·2-in. (24-ton) guns[4] 6 6-in. (5-ton) guns[4] 10 Nordenfelt guns 18 Whitehead torpedoes. Boat and field guns, &c. 4 6-pr. quick-firing guns
Complement of officers and men	430	514[5]	514[5]
	Tons.	Tons.	Tons.
Water and tanks	48	45	45
Provisions, with tare . . .	68	82[6]	82[6]
Officers' stores and slops . .	16	23[6]	23[6]
Officers, men, and effects . .	54	63[6]	63[6]
Masts, spars, and rigging . .	120	135	35
	(Fully rigged	on two masts.)	(One mast with fighting top)

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[1] The beam was increased by one foot, by an addition to the thickness of the wood sheathing, between the date of the preliminary design, as detailed to Parliament in March, 1881, and the finished design. The ship, as finally laid off, and with the increased beam, had an additional displacement of 210 tons, making her total displacement to the designed load line 7600 tons.

[2] The figures given for the complete ship represent the actual performances.

[3] 500 tons additional coal represents 13½ inches increased draught.

[4] Increase of weight due to development of design of guns.

[5] Complement as fixed on commissioning.

[6] These weights vary with the complement of officers and men.

The Impérieuse and Warspite.

IMPÉRIEUSE—*continued.*

—	As Designed.	As Completed for Trial Cruise, August, 1886.	When Complete, after Removal of Masts (Estimated), December, 1886.
	Tons.	Tons.	Tons.
Anchors and cables . . .	102	91	91
Boats.	52	39[1]	39[1]
Warrant officers' stores . .	50	50[2]	37[2]
Guns, carriages and slides, powder, projectiles, torpedoes, electrical stores, &c. . . .	365	500[3]	500[3]
Machinery, propelling . . .	1,180	1,266[4]	1,266[4]
Engines for ventilating ship, electric lighting, lifting boats, capstan, steering, torpedoes, &c.	30	50[5]	70[6]
Engineers' stores	40	40	40
Coals.	400	900[7]	900[7]
Torpedo net defence . . .	.. ..	25	25
Hull and armour	5,075	5,190[8]	5,185[8]
Totals	7,600	8,500	8,400

A report, by Captain Fane, of the behaviour of the Impérieuse at sea in October, 1886, was presented to Parliament during the session of 1887. The essential portions of the report describing the behaviour of the ship, which speak for themselves, are as follows:—

"With reference to the different paragraphs in the Admiralty letter before quoted, I think it best to answer their Lordships' questions in detail.

"(*a.*) Steering and manœuvring power under steam.

"Under five knots, although she steers fairly well, she is liable to become rather wild unless carefully watched, and with any wind requires a good deal of weather helm, as much as two turns having been needed with a fresh breeze abeam. The amount depends on the strength of the breeze.

"Above five knots the steering gradually improves, until with from 9 or 10 knots up to full speed her steering power is very good indeed.

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[1] 2nd class torpedo boat omitted.

[2] Reduced on account of change of rig.

[3] As above noted for armament.

[4] Increase due to the decision not to fit locomotive boilers contemplated in design, and to the extension of the forced draught system.

[5] Includes the weight of the electric light machinery, not contemplated in the design.

[6] The weight of boat winches authorised to be fitted at this date is about 20 tons, ordered when rig was altered.

[7] As above noted for coals.

[8] Includes the additional fittings incidental to changes in armament, the extension of the torpedo and electrical arrangements, &c.; also the splinter deck over engines and boilers.

The Impérieuse and Warspite.

"The steam-steering gear works most satisfactorily, and can be disconnected and hand-gear put in use in less than two minutes from the order.

"(*b.*) Her steadiness as a gun platform is unquestionably good. When off Vigo I had an excellent opportunity of judging in comparison with the Colossus. We could have used our guns against her with undoubted effect when she was rolling 17 degrees to our 3¼ degrees; in fact, the Colossus took water into her turrets whilst we were comparatively quite steady, and certainly could have worked all our guns.

"(*c.*) She has behaved well under steam and sail, but under sail alone it requires a very strong breeze to make her move, and she then carries so much weather helm that it is difficult to steer or keep her off the wind, as I have before mentioned.

"She stayed from port tack in 12 minutes, and it was 16 minutes before she gathered way on new tack. She came well up to the wind within one point, where she hung; she then gathered 3 knots stern way, and I had practically to make a stern board to get her round.

"On the starboard tack she stayed in 6 minutes 30 seconds without gathering so much stern way; force of wind at the time, 4; water smooth; heel, 2½ degrees; speed, 4 knots.

"(*d.*) With all her weights on board, I consider she has the appearance of being over-weighted, but she is not sluggish in answering her helm if sufficient speed is kept up. She certainly appears to be, and is, buoyant, and lifts easily and well to the sea. I tried her off Gibraltar with 500 tons of coal on board, steaming against a heavy short sea at about seven knots. She plunged into it, dipping the bowsprit well under, but rose perfectly, the water clearing at once, and not coming further aft than the foremast. She was then trimmed about two feet by the stern.

"(*e.*) Having carefully noted the saving of coal by the increase of speed given by sail power under various conditions and trials, the weight of her masts and sails, the wind they hold when steaming against it, the difficulty in steering without steam, and therefore the danger of collision and the necessity of always having steam ready, I am decidedly of opinion it is most undesirable to retain her masts and sails. I consider they give only a minimum of good to a maximum of evil. I am also of opinion her fighting power would be much endangered by retaining the amount of rigging required for, perhaps, occasionally using sail to assist the steam power; and although when going into action I presume all masts, yards, &c., above the tops would be down, there would still remain a large

The Impérieuse and Warspite.

amount of wire-rigging and gear to not only foul the propellers, but endanger the lives of the barbette guns' crews underneath, and, perhaps, block the barbettes and prevent them from working, thus increasing the risk of accident, and inviting disaster. The weight of the masts, yards, and stores connected with them should be taken into consideration; the same weight in coal, not only for use but for protection, would be of so much more value.

"Should her masts be removed, I venture to suggest her derrick being lengthened, and fitted with a military top; the present height is much too low on account of heat and smoke from the funnels.

"If an increase in machine-gun fire is deemed desirable, I would suggest the advisability of fitting light tripod masts, or light masts, with as little rigging as possible, on account of the barbettes and guns' crews underneath.

"(*f.*) Torpedo ports.—With 800 tons of coal on board, in smooth water, the broadside torpedo ports could not be worked efficiently with speed on; the sea would certainly strike the torpedo, and either deflect it out of its course, or cause the tail to strike the port, and render the torpedo useless, and, perhaps, dangerous.

"After what I have been able to observe of the capabilities and efficiency of H.M.S. Impérieuse, I wish to record the high opinion I have of her as a fast ocean cruiser and powerful fighting ship. Although her draught of water with all weights on board is more than originally designed for, thus bringing the armour belt and torpedo ports lower than anticipated, this extra weight does not affect her manœuvring powers under steam, and with her four 9-in. barbette armour-piercing guns, that have such a large arc of training, her six 6-in. B.L. guns and machine guns, together with her great speed, I submit she would prove a formidable opponent to an enemy."

Alterations similar in character to those made in the Impérieuse were also made in the Warspite during construction.

It is understood that both Impérieuse and Warspite will go to sea without rigging, and with military masts only.

THE ORLANDO CLASS.

The Orlando class.

The five belted cruisers, Australia, Galatea, Narcissus, Orlando, and Undaunted, will, during 1887, have been delivered at the Royal Dockyards by the contractors who built them. Two others of the same class, Immortalité and Aurora, are building in the Royal Dockyards. The Immortalité was launched in June 1887, and the Aurora in November 1887.

The Orlando class.

The details of construction of these ships are given in *The Naval Annual* for 1886 at page 165.

The Orlando, Undaunted, Australia and Galatea, have made successful trials of their machinery, having been previously brought down to their load lines by ballast representing the guns and other weights not actually on board at the time. The results of the trials are given in the following table:—

Name.	Draught of Water.		Displacement.	Natural Draught.		Forced Draught.	
	Forward.	Aft.		Horse-power developed.	Speed of Ship.	Horse-power developed.	Speed of Ship.
Orlando	20 0	22 0	5,000	5,617	17·20 Patent Log.	8,622	19·25
Undaunted	20 0	22 0	5,000	5,640	17·00	8,602	19·40
Australia	20 0	22 0	5,000	..	..	8,876	18·80
Galatea	19′ 6	22 6	5,000	..	..	9,205	19·008

GREAT BRITAIN.

UNARMOURED SHIPS.

GREAT BRITAIN.—Unarmoured Cruising Ships, &c.

comp., composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; f. tu., fixed torpedo-tube; b. tu., bow do.; l. car., launching torpedo carriage; P., deck protected throughout; pp., deck protected amidships. The protecting decks in all these cases are at least one inch thick.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.		Length.		Beam.		Where Built.	Maker of Engines.	Date of Launch.	Cost.		Armament.		Speed.	Coal Endurance.	
														Hull.	Machinery.	Guns.	Fish Torpedo Dis-chargers		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
			Tons.		ft.	in.	ft.	in.	ft.	in.				£	£			knots.	tons.	knots.
Sloop	**Acorn**	*Comp.*	970	1390 forced draught.	14	0	167	0	32	0	Milford Haven	Maudslay	1884	27,500	14,500	8 5-in. 38-cwt. B.L.R., 8 M., 1 l.	..	11·50	150	1900
Corvette	**Active**	Iron wood and copper sheathed	3080	4130	21	4	270	0	42	0	Blackwall	Humphrys	1869	85,795	40,361	10 6-in. 81-cwt. B.L.R., 2 64-pdrs. M.L.R., 10 M., 2 l.	2 l. car.	15·10	410	2000
Desp. Vessel	**Alacrity** 2 *s.*	Steel.	1400	3180	14	0	250	0	32	6	Jarrow	Palmer	1885	[x] 48,289	[y] 29,680	4 5-in. B.L.R., 4 Q.F., 2 M.	..	17·00	400	6450
Sloop	**Albatross**	*Comp.*	940	840	14	5	160	0	31	4	Chatham	Humphrys	1873	28,729	9,697	2 90-cwt. M.L.R., 2 64-pdr. do., 4 M., 1 l.	..	10·51	100	1000
Gun Vessel	**Algerine**	*Comp.*	835	810	13	7	157	0	29	6	Belfast	Laird	1880	25,896	10,556	2 64-pr. M.L.R., 2 5-in. 40-cwt. B.L.R., 4 M., 1 l.	..	10·50	110	1100
2nd Class Cruiser pp.	**Amphion** 2 *s.*	Steel	3750	5550	20	6	300	0	46	0	Pembroke	Maudslay	1883	95,000	65,500	10 6-in. 4-ton B.L.R., 14 M., 2 l.	4 l. car.	17·00	1000	11,000
Gun Vessel	**Arab**	*Comp.*	720	660	13	9	150	0	28	6	Glasgow	Napier	1874	25,041	9,982	1 90-cwt. M.L.R., 1 64-pdr. do., 2 20-pdr. B.L.R., 2 M., 1 l.	..	10·26	70	790
Torpedo Cruiser	**Archer (3)** 2 *s.*	Steel	1630	4122	14	6	225	0	36	0	Glasgow	Thomson	1886	[x] 55,916	[y] 31,667	6 6-in. 5-ton B.L.R., 8 Q.F., 2 M., 1 l.	1 f. tu. 4 l. car.	17·80	475	7000
2nd Class Cruiser pp.	**Arethusa** 2 *s.*	Steel	3750	5500	20	6	300	0	46	0	Glasgow	Napier	1882	86,763	58,435	10 6-in. 5-ton B.L.R., 16 M., 2 l.	4 l. car.	17·00	1000	11,000
Gun Vessel	**Avon** 2 *s.*	*Comp.*	603	530	9	7	155	0	25	0	Portsm'th	Maudslay	1867	16,547	5,797	1 90-cwt. M.L.R., 1 64-pdr. do., 2 20-pdr. do., 2 M.	..	10·31	90	—
Corvette	**Bacchante**	Iron wood and zinc sheathed	4130	5120	23	9	280	0	45	6	Portsm'th	Rennie	1876	152,454	76,954	4 6-in. M.L.R., 10 90-cwt. M.L.R., 12 M., 8 l.	2 l. car.	15·06	570	4070
	Boadicea	Iron [illegible]	4140	5130	23	[illegible]	280	0	45	0	Portsm'th	Rennie	1875	158,167	70,409	2 6-in. 81-cwt. M.L.R., 12 90-cwt. M.L.R., 4 Q.F., 11 M., [illegible]	2 l. car.	14·70	570	3000

																	6 6-in. 5-ton B.L.R., 8 Q.F., 2 M., 1 l.	1 f. tu. 4 l. car.	17·00	475	7000
Corvette .	Briton .	.	Wood	1860	2150	17	1	220	0	36	0	Sheerness	Rennie .	1869	89,299	21,356	14 64-pdr. M.L.R., 2 l., 6 M. .	..	13·13	250	2664
Gun Vessel .	Bussard .	2 s.	*Comp.*	1140	2000	11	6	195	0	28	0	Sheerness	Barrow .	1887	x45,000 estim'td	y15,000 estim'td	8 5-in 38-cwt. B.L.R. guns, 8 M.	—	14·50 estd.	280	5000
Corvette, pp. .	Calliope .	.	Steel wood & copper sheathed	2770	4020	19	11	235	0	44	6	Portsm'th	Rennie .	1884	82,000	38,000	4 6-in. 5-ton B.L.R., 12 5-in. 36-cwt. do., 10 M., 2 l.	2 l. car.	13·75	550	4000
” ” .	Calypso .	.	Steel Do.	2770	3720	19	11	235	0	44	6	Chatham	Rennie .	1883	82,000	37,500	4 6-in. 5-ton B.L.R., 12 5-in. 36-cwt. do., 10 M., 2 l.	2 l. car.	13·75	550	4000
” ” .	Canada .	.	Steel Do.	2380	2430	19	1	225	0	44	6	Portsm'th	Rennie .	1881	78,000 estim'td	26,500 estim'td	10 6-in. 81-cwt. B.L.R., 6 M., 2 l.	2 l. car.	13·00	470	5400
” ” .	Caroline .	.	*Comp.*	1420	1440	15	9	200	0	38	0	Sheerness	Maudslay .	1882	56,000 estim'td	15,000 estim'td	14 5-in. 38-cwt. B.L.R., 8 M., 1 l.	..	13·10	400	6400
” ” .	Carysfort .	.	Steel wood & copper sheathed	2380	2400	19	3	225	0	44	6	Glasgow .	Elder .	1878	84,512	29,942	2 90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	..	12·96	470	3840
” ” .	Champion.	.	Steel Do.	2380	2310	19	3	225	0	44	6	Glasgow .	Elder .	1878	84,288	29,695	2 90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	2 l. car.	13·00	470	3840
” ” .	Cleopatra .	.	Steel Do.	2380	2610	19	3	225	0	44	6	Glasgow .	Humphrys	1878	86,126	27,798	2 90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	2 l. car.	13·00	470	3280
” ” .	Comus .	.	Steel Do.	2380	2450	19	3	225	0	44	6	Glasgow .	Elder .	1878	84,497	29,477	4 6-in. 81-cwt. B.L.R., 8 64-pdr. M.L.R., 8 M., 2 l.	2 l. car.	12·93	470	3800
” ” .	Conquest .	.	Steel wood & copper sheathed	2380	2670	19	3	225	0	44	6	Glasgow .	Humphrys	1878	83,707	27,205	2 90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	2 l. car.	13·00	470	3280
” ” .	Constance.	.	Steel Do.	2380	2590	19	3	225	0	44	6	Chatham .	Penn .	1880	78,000 estim'td	32,000 estim'td	2 90-cwt. M.L.R., 12 64-pdr. do., 6 M., 2 l.	2 l. car.	13·72	470	5000
” ” .	Cordelia .	.	Steel Do.	2380	2420	19	3	225	0	44	6	Portsm'th	Rennie .	1881	78,000 estim'td	26,500 estim'td	10 6-in. 81-cwt. B.L.R., 10 M., 2 l.	2 l. car.	13·00	470	5400
Sloop . .	Cormorant	.	*Comp.*	1130	950	15	3	170	0	36	0	Chatham .	Humphrys	1877	37,630	11,587	2 90-cwt. M.L.R., 4 64-cwt., 64-pdr. M.L.R., 6 M., 1 l.	..	11·31	150	1500
Torpedo Cruiser	Cossack (3)	2 s.	Steel	1630	4003	14	6	225	0	36	0	Glasgow .	Thomson .	1886	x 55,916	y 31,667	6 6-in. 5-ton B.L.R., 8 Q.F., 2 M., 1 l.	1 f. tu. 4 l. car.	18·00	475	7000
Corvette, pp. .	Curaçoa .	.	Steel wood & copper sheathed	2380	2510	19	3	225	0	44	6	Glasgow .	Humphrys	1878	85,833	27,098	4 6-in. 5-ton B.L.R., 8 5-in. 40-cwt. do., 10 M., 2 l.	2 l. car.	13·00	470	3280
Gun and Torpedo Vessel . .	Curlew .	2 s.	Steel	785	1500	10	6	195	0	28	0	Devonp'rt	Penn .	1886	x 37,363	y 12,600	1 6-in. 5-ton B.L.R., 3 5-in. 38-cwt. B.L.R., 7 M.	1 b. tu. 4 l. car.	15·00	250	10,000
Sloop . .	Daphne .	.	*Comp.*	1140	2000	11	6	195	0	28	0	Sheerness	..	Bldg.	..	..	8 5-inch 40-cwt. B.L.R., 8 M. .	..	14·5	160	..
Sloop . .	Daring .	.	*Comp.*	940	920	14	7	160	0	31	4	Blackwall	Penn .	1874	30,023	9,590	2 90-cwt. M.L.R.; 2 64-pdr. do., 4 M., 1 l.	..	10·64	100	1000

x Includes Gun Mountings.

y Propelling Machinery.

GREAT BRITAIN.—Unarmoured Cruising Ships, &c.—*continued.*

comp., composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun: M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; f. tu. or b. tu., fixed or bow torpedo tube; l. car., launching torpedo carriage; P., deck protected; PP., partial deck protected. The protecting decks in all these cases are at least one inch thick.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.		Length.		Beam.		Where Built.	Maker of Engines.	Date of Launch.	Cost.		Armament.		Speed.	Coal Endurance.	
														Hull.	Machinery.	Guns.	Fish Torpedo Dischargers		Coal that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
			Tons.		ft.	in.	ft.	in.	ft.	in.				£	£			knots.	tons.	knots.
Corvette .	Diamond .	Wood	1970	2140	18	0	220	0	37	0	Sheerness	Hawthorn	1874	50,607	26,189	12 64-pdr. M.L.R., 6 M., 2 l.	..	12·56	270	2060
" .	Dido .	Wood	1760	2520	16	4	212	0	36	0	Portsm'th	Humphrys	1869	36,417	19,574	12 64-pdr. M.L.R., 6 M., 2 l.	..	13·50	250	1560
Sloop .	Dolphin .	*Comp.*	925	720	14	0	157	0	32	0	Middl'sbro	Hawthorn.	1882	25,850	9,800	2 6-in. 81-cwt. B.L.R., 2 5-in. 36-cwt. B.L.R., 3 M., 1 l.	..	11·30	135	1700
" .	Dragon .	*Comp.*	1130	1010	15	6	170	0	36	0	Devonp'rt	Maudslay.	1878	36,427	13,069	2 90-cwt. M.L.R., 4 64-pdr. do., 4 M., 1 l.	..	11·52	150	1480
Corvette .	Eclipse .	Wood	1760	1950	16	4	212	0	36	0	Sheerness	Napier	1867	39,242	24,084	12 64-pdr. M.L.R., 6 M., 2 l.	..	12·90	250	1630
Sloop .	Egeria (Surveying Service).	*Comp.*	940	1010	14	8	160	0	31	4	Pembroke	Humphrys	1873	32,468	10,414	4 20-pdr. B.L.R., 2 M., 1 l.	..	11·30	100	1000
Gun Vessel	Elk . . 2 *s.*	*Comp.*	603	470	8	9	155	0	25	0	Portsm'th	Penn	1868	16,107	5,775	1 90 cwt. M.L.R., 1 64-pdr. M.L.R., 2 20-pdr., 2 M.	..	9·25	100	—
Corvette .	Emerald .	*Comp.*	2120	2170	19	0	220	0	40	0	Pembroke	Thomson	1876	72,312	26,130	4 6-in. 81-cwt. B.L.R., 8 5-in. 38-cwt. do., 7 M., 2 l.	..	13·20	250	2280
" .	Encounter .	Wood	1970	2130	17	6	220	0	37	0	Sheerness	Rennie	1873	43,271	19,827	14 64-pdr. M.L.R., 6 M., 2 l.	..	13·19	260	2500
Sloop .	Espiegle .	*Comp.*	1130	1140	16	8	170	0	36	0	Devonp'rt	Maudslay.	1880	37,000 estim'td	11,770 estim'td	10 5-in. 40-cwt. B.L.R., 8 M., 1 l.	..	11·5	150	1460
Corvette .	Euryalus .	Iron wood and zinc sheathed	4140	5110	23	3	280	0	45	6	Chatham.	Easton and Anderson	1877	132,254	76,959	2 6-in. B.L.R., 12 90-cwt. M.L.R., 4 Q.F., 11 M., 3 l.	2 l. car.	14·72	550	2080
Gun Vessel	Falcon .	*Comp.*	780	720	13	0	157	0	29	6	Birkenh'd	Laird	1877	25,763	10,805	1 90-cwt. M.L.R., 2 64-pdr. do., 2 M., 1 l.	..	10·70	120	1990
Sloop .	Fantome	*Comp.*	940	970	14	2	160	0	31	4	Pembroke	Humphrys	1873	30,848	10,197	2 90-cwt. M.L.R., 2 64-pdr. do., 4 M., 1 l.	..	11·00	100	1000

Sloop . .	Flying Fish .	Comp.	940	840	14	2	160	0	31	4	Chatham.	Humphrys	1873	29,444	10,001	-cwt. B.L.R., 2 64-pdr., 6 M.	..	11·00	130	1170
2nd Class Cruiser P.	Forth (2) . 2 s.	Steel	3550	5700	20	0	300	0	46	0	Pembroke	Hawthorn.	1886	151,952	50,000	2 8-inch 15-ton B.L.R., 10 6-in. B.L.R., 3 Q.F., 12 M., 3 l.	3 tu. sub 4 l. car.	18·00	730	7400
Gun Vessel .	Frolic . 2 s.	Comp.	610	900	9	6	155	0	25	0	Chatham	Penn .	1872	16,512	6,593	1 90-cwt. M.L.R., 1 64-pdr. do., 2 20-pdr. B.L.R., 2 M.	..	10·70	80	880
Sloop . .	Gannet . .	Comp.	1130	1110	15	9	170	0	36	0	Sheerness	Humphrys	1878	39,581	12,889	2 90-cwt. M.L.R., 3 64-pdr. do., 2 5-in. 38-cwt. B.L.R., 6 M., 1 l.	..	11·53	150	1480
Corvette . .	Garnet . .	Comp.	2120	2000	19	7	220	0	40	0	Chatham.	Hawthorn.	1877	64,689	27,779	14 5-in. 40-cwt. B.L.R., 7 M., 2 l.	..	13·00	260	2000
Torpedo Gunboat	Grasshopper (4) 2 s.	Steel	450	3000	8	0	200	0	23	0	Sheerness	Maudslay	1887	x 20,897	y 13,168	1 4-in. 25-cwt. B.L.R., 6 Q.F. .	2 f. tu. 2 l. car.	19·00	100	3050
Gun Vessel .	Griffon . .	Comp.	780	790	13	2	157	0	29	6	Birkenh'd	Laird .	1876	25,330	10,794	2 5-in. 38-cwt. B.L.R., 2 64-pdr. do., 6 M.	..	10·87	120	1990
Torpedo Depôt Ship.	Hecla . .	Iron.	6400	2260	24	3	391	7	38	9	(Purchased) Built and Engined by Harland & Wolff.		1878	126,190		4 64-pdr. M.L.R., 1 5-in. B.L.R., 1 40-pdr. B.L.R., 8 M.	4 f. tu.	11·7	2,200	26,400
Corvette, pp. .	Heroine . .	Comp.	1420	1130	15	9	200	0	38	0	Devonp'rt	Humphrys.	1881	52,500	14,500	8 6-in. 81-cwt. B.L.R., 4 M., 1 l.	..	13·11	400	6000
„ „ .	Hyacinth . .	Comp.	1420	1190	15	9	200	0	38	0	Devonp'rt	Humphrys.	1881	52,500	14,500	8 6-in. 81-cwt. B.L.R., 4 M., 1 l.	..	13·10	400	6000
Sloop . .	Icarus . .	Comp.	970	1230	13	6	167	0	32	0	Devonp'rt	Barrow .	1886	x39,369	y12,735	8 5-in. 38-cwt. B.L.R., 8 M., 1 l.	..	12·5	150	2300
Frigate . .	Inconstant .	Iron wood and copper sheathed	5780	7360	25	6	337	4	50	3	Pembroke	Penn .	1868	138,585	74,739	10 12-ton M.L.R., 6 6½-ton M.L.R., 6 20-pdr. B.L.R., 13 M., 3 l.	2 l. car.	16·20	750	2780
Despatch Vessel	Iris . . 2 s.	Steel	3730	7330	22	0	300	0	46	0	Pembroke	Maudslay .	1877	110,868	102,318	10 64-pdr. M.L.R., 10 M., 2 l.	4 l. car.	17·98	780	4400
Sloop . .	Kingfisher .	Comp.	1130	1090	15	9	170	0	36	0	Sheerness	Maudslay .	1879	39,300 estim'td	11,850 estim'td	2 90-cwt. M.L.R., 4 64-pdr. do., 4 M, 1 l.	..	11·60	150	1480
Gun and Torpedo Vessel.	Landrail . 2 s.	Steel	785	1500	10	6	195	0	28	0	Devonp'rt	Penn .	1886	37,363	12,600	1 6-in. 5-ton B.L.R., 3 5-in. 38-cwt. B.L.R., 7 M.	1 b. tu. 4 l. car.	15·0	250	10,000
2nd Class Cruiser, pp.	Leander . 2 s.	Steel	3750	5500	20	6	300	0	46	0	Glasgow .	Napier .	1882	87,843 estim'td	60,610 estim'td	10 6-in. 5-ton. B.L.R., 14 M., 2 l.	4 l. car.	17·00	1000	11,000
Gun Vessel .	Lily . . .	Comp.	720	830	13	6	150	0	28	6	Glasgow .	Napier .	1874	24,141	9,967	1 90-cwt. M.L.R., 2 64-cwt. do., 2 M., 1 l.	..	10·60	70	750
„ . .	Linnet . 2 s.	Comp.	756	1050	10	11	165	0	29	0	Blackwall	Rennie .	1880	25,281	10,382	2 90-cwt. M.L.R., 3 20-pdr. B.L.R., 2 M.	..	11·80	180	2400

x Includes Gun Mountings, &c.

y Propelling Machinery.

GREAT BRITAIN.—Unarmoured Cruising Ships, &c.—*continued.*

comp., composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; f. tu. or b. tu., fixed or bow torpedo-tube; l. car., launching torpedo carriage; P., protected; pp., partial deck protected. The protecting decks in all these cases are at least one inch thick.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.	Length.	Beam.	Where Built.	Maker of Engines.	Date of Launch.	Cost. Hull.	Cost. Machinery.	Armament. Guns.	Armament. Fish Torpedo Dischargers	Speed.	Coal Endurance. Coals that can be carried in Bunkers.	Coal Endurance. Distance that can be steamed at 10 knots speed.
			tons.		ft. in.	ft. in.	ft. in.				£	£			knots.	tons.	knots.
2nd Class Cruiser P.	**Magicienne** (1) .	Steel wood and copper sheathed	2950	9000	..	265 0	41 0	Glasgow	Hawthorn	Bldg.	..	..	6 6-in. 5-ton B.L.R., 10 Q.F., 8 l.	..	19·75	400	8000
" " P.	**Marathon** (1) .	Steel wood and copper sheathed	2950	9000	..	265 0	41 0	Glasgow	Hawthorn	Bldg.	..	..	6 6-in. 5-ton B.L.R., 10 Q.F., 8 l.	..	19·75	400	8000
Sloop . .	**Mariner** . .	*Comp.*	970	970	14 0	167 0	32 0	Devonp'rt	Hawthorn.	1884	37,156	12,841	8 5-in. 35-cwt. B.L.R., 8 M., 1 l.	..	11·50	150	2300
2nd Class Cruiser P.	**Medea** (1) . 2 *s.*	Steel	2800	9000	..	265 0	41 0	Chatham	..	Bldg.	..	..	6 6-in. 5-ton B.L.R., 10 Q.F., 3 M.	..	20·00	400	8000
" " P.	**Medusa** (1) 2 *s.*	Steel	2800	9000	..	265 0	41 0	Chatham	..	Bldg.	..	..	6 6-in. 5-ton B.L.R., 10 Q.F., 3 M.	..	20·00	400	8000
Sloop . .	**Melita** . .	*Comp.*	970	1200	13 6	167 0	32 0	Malta .	..	Bldg.	53,000		8 5-in. 40-cwt. B.L.R., 8 M., 1 l.	..	12·50	150	2300
2nd Class Cruiser P.	**Melpomene** (1) 2 *s.*	Steel wood and copper sheathed	2950	9000	..	265 0	41 0	Portsm'th	..	Bldg.	..	..	6 6-in. 5-ton B.L.R., 10 Q.F., 3 M.	..	19·75	400	8000
Despatch Vessel	**Mercury** . 2 *s.*	Steel	3730	7290	22 0	300 0	46 0	Pembroke	Maudslay	1878	119,452	93,800	13 5-in. 40-cwt. B.L.R., 4 Q.F., 7 M., 1 l.	4 l. car.	18·00	780	4950
2nd Class Cruiser P.	**Mersey** (2) . 2 *s.*	Steel	3550	6000	20 0	300 0	46 0	Chatham.	Humphrys.	1885	100,000 estim'td	54,000 estim'td	2 8-in. 15 ton B.L.R., 10 6-in. B.L.R., 3 Q.F., 12 M., 8 l.	2 tu. sub 4 l. car.	18·00	720	7400
Sloop . .	**Miranda** . .	*Comp.*	1130	1020	15 9	170 0	36 0	Devonp'rt	Napier .	1879	37,000	11,700	2 90-cwt. M.L.R., 4 64-pdr. do., 4 M., 1 l.	..	11·50	150	1480
Torpedo Cruiser.	**Mohawk** (3) 2 *s.*	Steel	1630	3500	14 6	225 0	36 0	Glasgow .	Thomson .	1886	*x*55,916	*y*31,667	6 6-in. 5-ton B.L.R., 9 Q.F., 2 M., 1 l.	1 f. tu. 4 l. car.	17·00	475	7000
Sloop . .	**Mutine** . .	*Comp.*	1130	1120	15 9	170 0	36 0	Devonp'rt	Maudslay .	1880	37,500	11,770	10 5-in. 40-cwt. B.L.R., 6 M., 1 l.	..	12·10	150	1480
Gun Vessel .	**Myrmidon** .	Wood	877	720		..	..	..	..	Bldg.	..	..	4 20-ton B.L.R., 2 M. .	..	10·10	..	..
Sloop	**Nymphe**	Comp.	1140	2000		..	.	Portsm'th	.	Bldg.	..	..	8 5-in. 40-cwt. B.L.R., 8 M. .	..	15·00	..	..
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Napier	[illegible]	[illegible]	[illegible]	12 64-pdr. [illegible]	..	[illegible]	270	2250
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	100	1480

											Devonp'rt	Laird	1878	86,697	12,809	2 90-cwt. M.L.R., 4 64 pdr. do., 4 M., 1 l.	..	11·47	150	1750
„	**Pelican**	*Comp.*	1130	1060	15	8	170	0	36	0	Devonp'rt	Humphrys	1877	41,282	14,939	2 6-in. 81-cwt. B.L.R., 6 5-in. 38-cwt. B.L.R., 4 M., 1 l.	..	12·00	150	1480
„	**Penguin**	*Comp.*	1130	1110	16	1	170	0	36	0	Glasgow	Hawthorn.	1876	39,611	12,500	2 90-cwt. M.L.R., 2 5-in. 38-cwt. B.L.R., 8 64-pdr. M.L.R., 4 M., 1 l.	..	11·00	150	1500
2nd Class Cruiser, pp.	**Phaeton** 2 s.	Steel	3750	5500	20	6	300	0	46	0	Glasgow	Napier	1883	86,763	58,435	10 6-in. 5-ton B.L.R., 16 M., 2 l.	4 l. car.	17·00	1000	11,000
Torpedo Ram, P.	**Polyphemus** 2 s.	Steel	2640	5520	20	0	240	0	40	0	Chatham.	Humphrys.	1881	114,000	60,450	2 Q.F., 6 M.	5 tu. sub	17·80	300	3,400
Torpedo Cruiser.	**Porpoise** (3) 2 s.	Steel	1630	3500	14	6	225	0	36	0	Glasgow	Thomson	1886	[x]55,916	[y]31,667	6 6-in. 5-ton B.L.R., 8 Q.F., 2 M., 1 l.	1 f. tu. 4 l. car.	17·00	475	7000
Corvette, pp.	**Pylades**	*Comp.*	1420	1640	15	9	200	0	38	0	Sheerness	Laird	1884	45,500	16,500	14 5-in. 38-cwt. B.L.R., 8 M., 1 l.	..	13·00	400	6400
Sloop	**Racer**	*Comp.*	970	920	14	0	167	0	32	0	Devonp'rt	Hawthorn.	1884	37,000	12,000	8 5-in. 38 cwt. B.L.R., 8 M., 1 l.	..	11·50	150	2300
Torpedo Cruiser	**Racoon** (3). 2 s.	Steel	1630	4500	13	6	225	0	36	0	Devonp'rt	Harland	..	[x]60,606	[y]31,000	6 6-in. B.L.R., 8 Q.F., 2 M., 1 l.	1 f. tu. 4 l. car.	17·00	475	7000
Frigate	**Raleigh**	Iron wood and copper sheathed	5200	5640	24	7	298	0	49	0	Chatham.	Humphrys.	1873	147,248	46,138	8 90-cwt. M.L.R., 8 6-in. 81-cwt. B.L.R., 8 5-in. 38-cwt. do., 12 M., 4 l.	2 l. car.	15·50	550	2100
Gun Vessel	**Rambler** (Surveying service).	*Comp.*	835	690	13	7	157	0	29	6	Glasgow	Elder	1880	26,625	10,418	4 20-pdr. B.L.R., 1 M., 1 l.	..	10·66	40	1050
„ „	**Ranger**	*Comp.*	835	760	13	7	157	0	29	6	Glasgow	Elder	1880	26,558	10,710	1 90-cwt. M.L.R., 2 64-pdr. do., 2 M., 1 l.	..	10·95	110	1500
Corvette, pp.	**Rapid**	*Comp.*	1420	1400	15	9	200	0	38	0	Devonp'rt	Maudslay	1883	52,107	16,119	2 6-in. 81-cwt. B.L.R., 10 5-in. 38-cwt. do., 4 M., 1 l.	..	13·00	400	6000
Torpedo Gunboat	**Rattlesnake** (4) 2 s.	Steel	450	2700	8	0	200	0	23	0	Birkenh'd	Laird	1886	[x]21,425	[y]14,000	1 4-in. 25-cwt. B.L.R., 6 Q.F.	2 f. tu. 2 l. car.	19·00	100	3050
Gun Vessel	**Ready** 2 s.	*Comp.*	610	890	9	10	155	0	25	0	Chatham.	Penn	1872	17,231	6,613	1 7-in. 6½-ton M.L.R., 1 64-pdr. do., 2 20-pdr. B.L.R., 2 M.	..	11·10	80	880
Sloop	**Reindeer**	*Comp.*	970	1030	14	6	167	0	32	0	Devonp'rt	Hawthorn.	1883	34,834	52,787	6 5-in. 36-cwt. do., 8 M., 1 l.	..	11·50	150	2300
Gun Vessel	**Rifleman** 2 s.	*Comp.*	610	710	10	1	155	0	25	0	Chatham.	Penn	1872	17,970	6,589	2 90-cwt. M.L.R., 2 20-pdr. B.L.R., 2 M.	..	10·71	80	880
Corvette	**Rover**	Iron wood and zinc sheathed	3460	4960	23	0	280	0	43	6	Blackwall	Ravenhill	1874	104,718	65,021	14 6-in. 81-cwt. B.L.R., 8 M., 3 l.	2 l. car.	14·53	410	1840
„ pp.	**Royalist**	*Comp.*	1420	1510	13	9	200	0	38	0	Devonp'rt	Maudslay	1883	52,134	16·039	2 6-in. 81-cwt. B.L.R., 10 5-in. 38-cwt. do. 4 M 1.	..	13·00	400	6000

[x] Included Gun Mountings, &c.

[y] Propelling Machinery.

GREAT BRITAIN.—Unarmoured Cruising Ships, &c.—*continued.*

comp. composite hull; 2 *s.*, two screws; M.L.R., muzzle-loading rifled gun; B.L.R., breech-loading rifled gun; M., machine gun; Q.F., quick-firing gun; l., light guns under 15 cwt., including boats' guns; f. tu. or b. tu., fixed or bow torpedo tube; l. car., launching torpedo carriage; P., deck protected; pp., partial deck protected. The protecting decks in all these cases are at least one inch thick.

Class.	NAME.	Material of Hull.	Displacement.	Indicated Horse-Power.	Draught of Water.		Length.		Beam.		Where Built.	Maker of Engines.	Date of Launch.	Cost.		Armament.		Speed.	Coal Endurance.	
														Hull.	Machinery.	Guns.	Fish Torpedo Dischargers		Coals that can be carried in Bunkers.	Distance that can be steamed at 10 knots speed.
			tons.		ft.	in.	ft.	in.	ft.	in.				£	£			knots.	tons.	knots.
Corvette	**Ruby**	*Comp.*	2120	1830	18	8	220	0	40	0	Hull	Earle	1876	66,113	27,003	12 64-pdr. M.L.R., 6 M., 2 l.	..	12·28	260	2080
Torpedo Gunboat	**Sandfly** (4) 2 *s.*	Steel	450	3000	8	0	200	0	23	0	Devonp'rt	Maudslay	1887	x 22,877	y 13,290	1 4-in. 25-cwt. B.L.R., 6 Q.F.	2 f. tu. 2 l. car.	19·00	100	3050
Corvette	**Sapphire**	Wood	1970	2360	18	1	220	0	37	0	Devonp'rt	Hawthorn	1874	51,986	26,311	12 64-pdr. M.L.R., 6 M., 2 l.	..	13·58	270	2080
Corvette, pp.	**Satellite**	*Comp.*	1420	1400	15	9	200	0	38	0	Sheerness	Humphrys	1881	47,500	15,400	8 6-in. 81-cwt. B.L.R., 4 M., 1 l.	..	13·10	400	6000
Torpedo Cruiser.	**Scout** (3) 2 *s.*	Steel	1430	3200	14	6	220	0	34	0	Glasgow	Thomson	1885	x63,916	y28,600	4 5-in. B.L.R., 8 Q.F., 2 M., 1 l.	3 f. tu. 4 l. car.	17·00	450	6900
,, ,,	**Serpent** (3) 2 *s.*	Steel	1630	4500	14	6	225	0	36	0	Devonp'rt	Harland	1887	60,606	31,000 estim'td	6 6-in. 5-ton B.L.R., 8 Q.F., 12 M., 1 l.	1 f. tu. 4 l. car.	17·00	475	7000
2nd Class Cruiser, P.	**Severn** (2). 2 *s.*	Steel	3584	6158	20	0	300	0	46	0	Chatham	Humphrys	1885	x 151,681	y60,940	2 8-in. 15-ton B.L.R., 10 6-in. B.L.R., 3 Q.F., 12 M., 3 l.	2 tu. sub 4 l. car.	18·17	720	7408
Frigate	**Shah**	Iron wood and copper sheathed	6250	7480	26	5½	334	0	52	0	Portsm'th	Ravenhill	1873	177,912	57,833	2 12-ton M.L.R., 16 6½-ton do., 8 5-in. B.L.R., 4 Q.F., 12 M., 4 l.	2 l. car.	16·20	890	6840
Torpedo Gunboat	**Sharpshooter** (7) 2 *s.*	Steel	450	3000	8	0	200	0	23	0	Devonp'rt	..	1887	x 23,000	y 13,300	1 4-in. 25-cwt. B.L.R., 6 Q.F.	2 f. tu. 2 l. car.	19·00	100	3050
Torpedo Gunboat	**Spider** (4). 2 *s.*	Steel	450	3000	8	0	200	0	23	0	Devonp'rt	Maudslay	1887	x 23,000	y 13,300	1 4-in. 25-cwt. B.L.R., 6 Q.F.	2 f. tu. 2 l. car.	19·00	100	3050
Despatch Vessel.	**Surprise** 2 *s.*	Steel	1400	3030	14	0	250	0	32	6	Jarrow	Palmer	1885	x49,084	y29,080	4 5-in. 38-cwt. B.L.R., 4 Q.F., 2 M., 1 l.	..	17·00	400	6450
Gun Vessel	**Swallow** 2 *s.*	*Comp.*	1135	1500	11	0	195	0	28	0	Sheerness	Rennie	1885	44,707	15,000	8 5-in. 38-cwt. B.L.R., 8 M.	..	13·50	280	5000
	Swift 2 *s.*	*Comp.*	756	1010	10	11	165	0	30	0	Blackwall	Rennie	1879	24,280	10,880	2 90-cwt. M.L.R., 3 20-pdr. B.L.R., 2 M.	..	11·81	160	2400
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Glasgow	Thomson	1886	[illegible]	[illegible]	[illegible]	1 f. tu. 4 l. car.	17·[illegible]	470	7000

													Napier .	1869	47,915	21,709	6 64-pdr. M.L.R., 2 M., 2 l. .	..	11·14	230	2850
2nd Class Cruiser P.	Thames (2)	2 s.	Steel	3550	5700	20	0	300	0	46	0	Pembroke	Penn .	1886	151,952	58,500	2 8-in. 15-ton B.L.R., 10 6-in. B.L.R., 8 Q.F., 12 M., 3 l.	2 tu. sub 4 l. car.	18·00	720	7400
Corvette . .	Tourmaline .		*Comp.*	2120	2000	18	8	220	0	40	0	Middl'sbro	Hawthorn.	1875	69,998	25,771	4 6-in. 89-cwt. B.L.R., 8 5-in. 38-cwt. do., 8 M., 2 l.	..	12·62	280	2000
,, . .	Turquoise .		*Comp.*	2120	1990	19	1	220	0	40	0	Hull .	Earle .	1876	68,089	27,458	12 64-pdr. M.L.R., 6 M., 2 l. .	..	12·32	280	2080
Torpedo Vessel .	Vesuvius .	2 s.	Iron	245	390	8	6	90	0	22	0	Pembroke	Maudslay .	1874	10,522	7,465	Nil	4 tu.	9·71	25	—
2nd Class Cruiser	Volage . .		Iron wood and copper sheathed	3080	4530	22	0	270	0	42	0	Blackwall	Ravenhill .	1874	91,817	41,000	10 6-in. 81-cwt. B.L.R., 2 64-pdr. M.L.R., 10 M., 2 l.	2 l. car.	15·30	420	1850
Sloop . .	Wanderer .		*Comp.*	925	750	14	0	157	0	32	0	Middl'sbro	Hawthorn.	1883	25,850	9,800	2 6-in. 81 cwt. B.L.R., 2 5-in. 36-cwt. do., 2 M., 1 l.	..	11·30	135	1700
,, . .	Wild Swan .		*Comp.*	1130	1090	15	10	170	0	36	0	Glasgow .	Hawthorn.	1876	39,643	11,853	2 6-in. 81-cwt. B.L.R., 6 5-in. 38-cwt. do., 4 M., 1 l.	..	11·35	150	1120

x Includes Gun Mountings, &c.

y Propelling Machinery.

Royal Naval Reserved Merchant Cruisers.

List of Vessels held by the Owners at the disposition of the Lords Commissioners of the Admiralty.

	Name.	Owners.	Length.	Breadth.	Maximum Draught of Water for the Admiralty List.	Gross Tonnage.	Average Ocean Speed.
			Feet.	Feet.	Feet.	Tons.	Knots.
With Subvention.	Etruria	Cunard Company	501·5	57·2	26	7,718	18½
	Umbria	" "	501·5	57·2	26	7,718	18½
	Aurania	" "	470	57·2	26	7,269	16½
	Victoria	Peninsular and Oriental Co.	466	52	22½	6,300	15¼*
	Britannia	" " "	466	52	22½	6,300	15¼*
	Oceana	" " "	466	52	22½	6,300	15¼*
	Twin Screw Ship, Building	White Star Company	565	58	—	10,000	19
	" " "	" "	565	58	—	10,000	19
	Britannic	" "	455	45·2	25	5,004	15
	Germanic	" "	455	45·2	25	5,008	15
	Adriatic	" "	437·2	40·9	23	3,888	14
	Celtic	" "	437·2	40·9	23	3,867	14
	Servia	Cunard Company	515	52·1	26	7,392	17
	Gallia	" "	430·1	44·6	24	4,809	15
	Arcadia	Peninsular and Oriental Co.	466	52	22½	6,300	15¼*
	Valetta	" " "	420·4	45·1	22½	4,911	15½
	Massilia	" " "	420·4	45·1	22½	4,908	15½
	Rome	" " "	430·1	44·4	22½	5,013	15
	Carthage	" " "	430·1	44·4	22½	5,013	15
	Ballarat	" " "	420·2	43	22½	4,752	14½
	Parramatta	" " "	420·2	43	22½	4,759	14½

There are numerous ships on the Admiralty List complying with Admiralty conditions as to subdivision which have no national tie. They are suitable for receiving an armament, but there is no arrangement with Owners, except the promise of preference for occasional State employment.

* Average speed of Britannia between Brindisi and King George's Sound, Western Australia. The average ocean speed is higher than this.

SMALLER VESSELS, GUNBOATS.

Smaller Vessels, &c.

Note.—Troop and store ships, yachts, armed tugs, harbour-service vessels, and surveying vessels are not included.

Paddle-wheel Vessels.—Alecto, Cockatrice, Helicon, Pioneer, Sphinx, Vigilant.

Screw Composite Gunboats.—Six very large vessels of this class are now building in the Royal Dockyards, viz., Partridge, Peacock, Pheasant, Pigeon, Pigmy, Plover. They have a displacement of 755 tons; I.H.P. 1200, and their speed will be 13½ knots. Their armament will consist of six 4-in. B.L.R. 25-cwt. guns, and four machine-guns. Four vessels of the class, but rather smaller, viz., Bramble, Lizard, Rattler, Wasp—displacement, 670 tons; I.H.P. 1000; speed, 13 knots, and armament the same as for the larger vessels—have already been built, and are, with the exception of the Wasp, lost at sea, on active service.

Albacore, Mistletoe, Watchful, 560 tons; I.H.P. 770; speed, 10·8 knots.

Ariel, Banterer, Bullfrog, Cockchafer, Coquette, Cygnet, Espoir, Express, Firebrand, Firefly, Firm, Forester, Forward, Foxhound, Goshawk, Grappler, Mallard, Merlin, Raven, Redwing, Starling, Stork, Swinger, Wrangler, Zephyr. From 430 to 465 tons; and from 310 to 520 I.H.P.; speed, 9½ to 10½ knots.

Older Type Gunboats.—Britomart, Cherub, Orwell, 330 tons; from 218 to 227 I.H.P.

Twin Screw Gunboats (Iron).—Dee, Don, Esk, Medina, Medway, Sabrina, Slaney, Spey, Tay, Tees, Trent, Tweed, 363 tons; 320 to 410 I.H.P.

Twin Screw Iron or Steel Gunboats (*Staunch Type*).—Bouncer, Insolent, Ant, Arrow, Badger, Blazer, Bloodhound, Bonetta, Bulldog, Bustard, Comet, Cuckoo, Fidget, Gadfly, Griper, Hyæna, Kite, Mastiff, Pickle, Pike, Pincher, Plucky, Scourge, Snake, Snap, Staunch, Tickler, Weasel, 180 to 254 tons; 130 to 270 I.H.P.

TORPEDO BOATS.

First Class.

19 of about 85 feet in length, 28 tons displacement, and 350 to 500 I.H.P.
2 of about 100 feet in length, 40 tons displacement, and 350 to 500 I.H.P.
4 of about 110 to 113 feet in length, 63 to 67 tons displacement.
48 of about 125 feet in length, 60 to 66 tons displacement, and 750 I.H.P.
5 of about 125 feet in length, 85 tons displacement, and 750 I.H.P.
1 of about 135 feet in length (Falke type), 87 tons displacement, and 1320 I.H.P.
1 of about 150 feet in length (late Swift), 137 tons displacement, and about 1300 I.H.P.
—
80

Second Class.

Smaller Vessels, &c.

50 of 60 to 66 feet in length, 12 tons displacement, and of 100 to 140 I.H.P.

TORPEDO BOATS (WOOD).

9 of 56 feet in length, 11 tons displacement, and 150 I.H.P.

The following vessels of various classes are noted in the official *Navy List* for October, 1887, as being non-effective for sea service, and mainly for sale:—

	Displacement.	I.H.P.
Algiers (late Anson)	5260	3583
Amethyst	1970	2140
Beacon	603	510
Bittern	805	850
Condor	780	770
Cracker	603	530
Flirt	603	530
Fly	603	490
Growler	603	700
Hart	603	610
Hornet	603	510
Jackal	505	430
Juno	2240	1380
Kestrel	610	830
Lynx	603	530
Midge	603	470
Modeste	1970	2180
Newcastle	4020	2354
Pert	603	500
Rocket	603	470
Sappho	940	880
Seagull	805	700
Teazer	603	490
Tenedos	1760	2030
Thetis	1860	2270
Thistle	603	640
Victoria (3 decker)	6959	4191

Indian Marine.

(The ironclad ships Abyssinia and Magdala, belonging to the Indian Government, are included in the list of Armoured Ships of the Royal Navy.)

Class of Ship.	Name.	Material of Construction.	Propellers.	Where Built.	When Launched	Length.	Breadth.	Draught of Water.	Displacement.	Indicated Horse-Power.	Speed.	Coal Storage.	Armament.
						ft. in.	ft. in.	ft. in.				Tons.	
Troop Ship .	Amberwitch	Iron .	1	Liverpool	1862	175 6	27 0	12 0	1,010	250	7·7	90	
Ditto . . .	Canning, was Golconda	Steel .	1	Glasgow	1882	285 0	36 2	16 8	3,300	1,080	10·6	400	
Ditto . . .	Clive . .	Iron and Steel	1	Birkenhead	1882	300 0	45 6	16 6	3,570	2,300	12·0	500	
Inland Steamer	Comet . .	Steel .	Pad.	..	..	..	..	..	144	190	..	..	Two 1-inch Nordenfelts.
Sailing Ship .	Czarewitch	Composite	..	Sunderland	1866	185 0	32 0	19 6	1,990				
Troop Ship .	Dalhousie .	Steel .	1	Greenock	B'lding.	239 6	36 0	15 7	1,960	1,500	13·0	300	Six 6-pr. Q.F. guns.
Surveying Ship	Investigator	Wood .	Pad.	Bombay	1881	180 0	25 8	11 3	856	660	10·5	105	
Inland Steamer	Irrawaddy	Iron .	Pad.	..	..	..	..	..	..	750	..	..	Two 20-prs. B.L.R.; two 9-prs. R.M.L.
Despatch Vessel	Lawrence .	Steel .	Pad.	Birkenhead	1886	212 2	32 2	18 3	1,154	1,200	13·5	270	Four 4-inch B.L.R.
Tug . . .	Madras .	Wood .	Pad.	Blackwall	1876	123 3	20 7	7 5	197	150 nom.	8·0	100	
Tug . . .	Manora .	Wood .	Pad.	Bombay	1869	141 5	26 0	12 1	420 B.M.	250	9·0	125	
Yacht . . .	May Frere	Wood .	Pad.	Bombay	1864	168 0	19 7	8 3	450	500	10·0	60	
Guard Ship .	Quangtung	Iron .	Pad.	Birkenhead	1863	185 3	24 7	11 3	900	520	..	160	Six 9-prs. R.M.L.
Inland Steamer	SirWm. Peel	Iron .	Pad.	..	..	..	..	..	302	600	..	..	Two 12-pr. Howitzers; four Nordenfelts M.G.
Inland Steamer	Sladen .	Steel .	Pad.	...	..	..	..	..	260	360	..	..	Two 12-pr. Howitzers; four Nordenfelts M.G.
Troop Ship .	Tenasserim	Iron .	1	London	1872	250 0	35 0	18 1	2,570	1,140	11·0	385	
Tug . . .	Undaunted	Iron .	Pad.	Dumbarton	1865	160 0	25 2	11 7	470	1,080	10·0	115	

Colonial Marine (Great Britain).

(The Ironclad Turret-ship Cerberus, belonging to the Victorian Government, is included in the list of Armoured Ships of the Royal Navy.)

To what Government belonging.	Class of Ship.	NAME.	Material of Construction.	Propellers.	Where Built.	When Launched.	Length.	Breadth.	Draught of Water.	Displacement.	Indicated Horse-Power.	Speed.	Coal Storage.	Armament.
							ft. in.	ft. in.	ft. in.				Tons.	
VICTORIA	Old line-of-battle ship	Nelson	Wood	1	Portsmouth	Converted 1860	216 3	54 6	..	4,096	2,102	10·0	..	Two 7-in. M.L.R.; 18 64-prs. M.L.R.; 12 32-prs.
	Gunboat	Albert	Steel	2	..	1883	115 0	25 0	10 0	350	400	10·0	..	One 8-in. 12-ton B.L.R.; one 6-in. 4-ton do.; two 9-prs. do.; two Nordenfelts.
	Gunboat	Victoria	Steel	2	..	1883	140 0	27 0	11 0	530	800	12·0	..	One 10-in. 25-ton B.L.R.; two 13-pr. B.L.R.; two 1-in. Nordenfelts.
	Gunboat	Batman	Iron	..	..	..	..	..	..	387	350	..	..	One 6-in. 4-ton B.L.R.; two Nordenfelts.
	Gunboat	Fawkner	Iron	..	..	..	..	..	..	387	350	..	..	One 6-in. 4-ton B.L.R.; two Gatlings.
	Gunboat	Gannet	Iron	..	..	..	..	..	..	346	500	..	..	One 6-in. 4-ton B.L.R.; two Nordenfelts.
	Gunboat	Lady Loch	..	..	..	..	..	..	..	..	..	..	..	One 6-in. 4-ton B.L.R.; two Nordenfelts.
	First class torpedo boat	Childers	Steel	1	Chiswick	1883	113 0	12 6	5 6	63	750	20·0	10	Two 1½-in. Hotchkiss guns.
QUEENSLAND	Gun-vessel	Gayundah	Steel	2	Glasgow	1884	115 0	25 0	10 0	360	400	10·0	..	One 8-in. 11½-ton B.L.R.; one 6-in. 4-ton do.; one 3-pr. Q.F.G.; two Nordenfelts.
	Gun-vessel	Paluma	Steel	2	Glasgow	1884	115 0	25 0	10 0	360	400	10·0	..	One 8-in. 11½-ton B.L.R.; one 6-in. 4-ton do.; one 3-pr. Q.F.G.; two Nordenfelts.
	Gunboat	Otter	Steel	2	..	..	..	..	..	120	92	..	..	One 64-pr. M.L.R.
	Gunboat	Bonito	Iron	2	..	..	..	..	..	450	400	..	..	.. ..
	Gunboat	Stingaree	Iron	2	..	..	..	..	..	450	400	..	..	.. ..
	Yacht	Lucinda	..	Pad.	..	..	..	..	..	..	..	..	..	.. ..
SOUTH AUSTRALIA	Cruiser	Protector	Steel	2	..	1884	188 0	30 0	12 6	920	1,640	14·0	..	One 8-in. 11½-ton B.L.R.; five 6-in. 4-ton do.; five Gatlings.

Note.—The Victorian Government also possesses two Second Class Steel Torpedo Boats and three Torpedo Launches; and the Queensland Government also possesses one Second Class Steel Torpedo Boat.

DETAILS OF CONSTRUCTION AND TRIALS OF RECENT SHIPS.

(1.) MEDEA, MEDUSA, MELPOMENE, MAGICIENNE, AND MARATHON.

Medea, Medusa, Melpomene, Magicienne, and Marathon.

THE most important vessels laid down for the British Government in 1887, as given in the First Lord's statement to Parliament, are the five ships above named. The first two are building at Chatham, the Melpomene at Portsmouth, and the Magicienne and Marathon by contract at the works of Messrs. Elder and Co. The Medea and Medusa are built of steel and are unsheathed. The other three are sheathed with wood and copper. A description of these vessels is given at p. 96 of the present volume.

The changes introduced into the design for the Melpomene, Magicienne, and Marathon involve an increase in the displacement to 2950 tons, a slight increase in draught of water, and a possible slight decrease in speed to about 19¾ knots. These changes, however, which also involve a small increase in the first cost, can well be accepted in view of the special services such vessels might be called upon to perform. In the armament, and in all other particulars, these three ships will be precisely similar to the steel-bottomed ships Medea and Medusa.

(2.) MERSEY, SEVERN, THAMES, AND FORTH.

Mersey, Severn, Thames, and Forth.

The four ships of the Mersey class, whose dimensions and other particulars were given in *The Naval Annual* for 1886 at page 200, have had their machinery tried, and the results are given below.

It may be noted that this class was the first in which the form of protection now so much in favour in all navies was adopted.

The protecting deck is situated above the water-line, except at its edges and ends, where it dips so as to meet the bottom plating several feet under the water.

The design of the Mersey was approved on the 10th January, 1883, and on the 12th of the same month orders were given to Chatham Dockyard to commence the ship.

Ships of the same type built for other countries in private yards, were commenced later and completed earlier than any of the ships of the Mersey class.

The mode of protection adopted in the Mersey as an alternative to side-armour protection had been advocated by several competent authorities before she was commenced.

Mersey.

In the Leander class, which preceded them by some years, the protecting deck is less substantial.

NAME.	Draught of Water.		Dis-placement.	Natural Draught.		Forced Draught.	
	Forward.	Aft.		Horse-power.	Speed.	Horse-power.	Speed.
Mersey . .	13·6	16·11	2915	..	..	6628	Speed not taken.
Severn . .	15·6	19·9	3584	..	..	6158	18·17
Thames .	12·3	17·3	2720	4495	17·00	5886	18·20 (Patent log.)
				(Mean draught of water on this trial was 7 inches in excess of that given, which was that for the forced-draft trial.)			
Forth . .	13·10	17·10	3100	..	..	5744	17·32 (weather unfavourable.)

Some important experiments were made with the Mersey—protected cruiser—in February 1887. The object of the experiments was to test a plan of launching Whitehead torpedoes under water without the use of the shield and guide bar used in the Polyphemus and other ships. Apertures about nine feet long were cut in the skin of the ship, the space inside tapering to the impulse tube, so as to admit of the missile being deflected on feeling the pressure of the water without endangering the delicate rear mechanism. Up to a speed of 12 knots fairly good runs were made; but when the vessel was driven at the *maximum* speed of 18 knots nothing but misfortunes occurred. One torpedo was lost, but was subsequently picked up on the beach at Osborne, and at the next discharge a second torpedo was completely broken up. It was at first supposed that the telescoping of the Whitehead was owing to too much pressure—which was equal to a force of 6000 lb.—being applied to the rear to shoot it out of the tube. The fact, however, that the head was violently wrenched off coupled with subsequent experience, seemed to warrant the conclusion that the fracture was due to the absence of the usual supports to the weapon until fairly away from the ship. Other experiments were afterwards prosecuted with dummy torpedoes, which when picked up after being fired were found to be severely scored by the friction to which they had been subjected in the act of launching. The behaviour of the torpedoes was also unsatisfactory, for instead of taking a course at right angles with the ship they ran parallel to her, and were in danger of being destroyed by the blades of the screw. In view of the results obtained in these trials, it is understood that

Mersey.

ships having under-water dischargers will be fitted with torpedo gear similar to that of the Polyphemus, which has answered well since modifications were made in the shield and bar.

(3.) THE ARCHER CLASS.

The Archer Class.

The ships of the Archer class, built by contract at Glasgow, and described in *The Naval Annual* for 1886 at page 204, and also the Fearless, sister to the Scout, have been completed, and the following results have been obtained on their steam trials:—

NAME.	Draught of Water.		Displacement.	Natural Draught.		Forced Draught.	
	Forward.	Aft.		Horse-power.	Speed.	Horse-power.	Speed.
Archer . .	12·6	14·6	1610	2404	15·00	3982	17·20
Brisk . .	12·6	14·6	1610	2617	15·75	—	—
Cossack .	12·6	14·6	1610	2557	16·25	3851	17·60
Mohawk .	12·5	14·9	1621	..	..	3398	16·87 (Two runs only.)
Porpoise .	12·5	14·6	1613	..	..	3944	17·57
Tartar . .	12·10	14·6	1647	..	..	3824	17·33
Fearless .	11·6	13·6	1360	..	..	3302	17·27

In *The Naval Annual* for 1886, the note upon the Scout class, on page 203, does some injustice to the firms of Sir Wm. Armstrong & Co. and Messrs. Hawthorn. In the fast war vessels designed and built by these firms, the use of forced draught with closed stokeholds for ordinary marine boilers, appears to have been suggested by Mr. George Rendel, without any knowledge at Newcastle of what was being done in this direction in the war vessels of France and Great Britain. The work was successfully carried out by the above-named firms as a new departure. The extraordinary success which has attended the use of closed stokeholds in war vessels makes it important to give the credit for the introduction where it is due. It appears to lie in the first place with Mr. Thornycroft, and then, quite independently of each other, with the French Génie Maritime and Mr. George Rendel.

(4.) THE TORPEDO GUNBOATS OF THE RATTLESNAKE CLASS.

Torpedo Gunboats of the Rattlesnake Class.

The Rattlesnake was launched on 11th September, 1886; the Grasshopper on 30th August, 1887; the Sandfly on 30th September, 1887; and the Spider on 20th October, 1887. Two others have been laid down in the Royal Dockyards.

These vessels are 200 ft. between perpendiculars, with a beam of 23 ft., and a depth of hold of 13 ft. They are built entirely of steel, and fitted with a half-poop and forecastle, and a conning tower with a conning bridge erected over it. In speed they equal some of the first-class torpedo boats; while, as they stand well out of the water and have good accommodation between decks, in seaworthiness, ability to keep the sea, and comfort for the crew, they are vastly superior. Their offensive power is also greater. In addition to one torpedo tube through the bow and another through the stern in a fore-and-aft line, and one on each broadside forward capable of training through 90 degrees, they will mount a 4-inch 25 cwt. central-pivot breechloader, capable of penetrating 3 in. of armour. This makes them formidable antagonists to all but heavily protected ships of war. The gun is surrounded by a steel screen attached to the carriage for the defence of the gunner against machine guns and rifle fire. They carry six three-pounder Hotchkiss quick-firing guns. Above the bridge an electric search-light is fitted.

In engining these vessels the paramount object has been to reduce all weights to a *minimum* consistent with efficiency. The contract power of the engines is, with forced draught, 2700 collective horse-power; and when it is considered that this enormous force is contained in a snake-like craft of only 450 tons, the character of the problem which the marine engineer has had to grapple with will be readily recognised. The boilers are protected at the forward end and at the sides by coal bunkers capable of stowing 90 tons of fuel, while the engines, which are not divided by bulkheads, are protected by extra thick plating on the sides of the vessel. In the design of the machinery advantage has been taken of the experience derived from the performances of the torpedo fleet. The propelling machinery of the Rattlesnake consists of two sets of vertical triple-expansion three-crank engines, having cylinders of 18½, 27, and 42 in. diameter respectively, with a stroke of 18 in., and capable of exerting 2700 horse-power at about 310 revolutions. The total condensing surface of the condensers amounts to 4000 square feet. The framing of the engines is entirely composed of

Torpedo Gunboats of the Rattlesnake Class.

steel, and this material has also been largely employed in the construction of the machinery throughout. The crank and other shafts have been manufactured of Whitworth special steel, and are hollow throughout. The propellers are made of solid manganese bronze they are three-bladed, and have a diameter of 6 ft. 6 in. and a pitch of 7 ft. 6 in. The boilers, four in number, are fitted in two stoke-, holds, which are wholly separate, so that there would be a chance of the vessel continuing an engagement after being partly disabled in her machinery. The boilers are of the locomotive type, but a new principle has been introduced of constructing them with wet bottoms, and with large conical-shaped tubes placed between the furnaces. In addition to increasing the heating surface, this plan affords an efficient means of circulating the water in the boilers. The working pressure is 140 lb. to the square inch, while the heating surface is about 4640 ft., and the area of fire-grate 122 ft. The stokeholds are fitted with four fans for providing the forced draught.

The Rattlesnake, on her trial in February last, was brought down to her load draught by means of iron ballast—namely, 6 ft. 9 in. forward, and 9 ft. 11 in. aft. After a short preliminary run, she proceeded on a three hours' official full-power trial, at the end of which the following mean results were obtained:—Steam in boilers 136 lb., which was less than the engines could have utilized; vacuum, 25 in.; revolutions, 311 starboard and 308 port; mean pressures—starboard, 59 lb. high, 28 lb. intermediate, and 13 lb. low; port, 58 lb. high, 28 lb. intermediate, and 11 lb. low; indicated horse-power, 1424·10 starboard and 1294·17 port; thus giving a collective indicated horse-power of 2718·27, which is slightly beyond the contract. The mean of six runs upon the measured mile gave a speed of 18·779 knots. It remains, however, to be stated that the weather was somewhat boisterous for so small a craft, the wind blowing from the south-west with a force of over 3.

On the 10th February the vessel was driven for six consecutive hours at a uniform speed of 11 knots, for the purpose of testing her coal endurance and water consumption, the latter being a somewhat novel ordeal, which is reserved for craft of the kind. The speed was maintained by a mean collective expenditure of power equal to 373 horses, which was secured by an average of 166 revolutions per minute. The consumption of fuel amounted to 2 lbs. per horse-power developed per hour by the main engines; but if the circulating fan, main feed, and steering engines be taken into consideration, this will be 1·9 lbs., the result proving that with her bunker capacity the Rattlesnake is capable of steaming, at 11 knots, Torpedo Gunboats of the Rattlesnake Class.

2800 miles, or a little more than the distance between Liverpool and New York. The consumption, or, more properly speaking, the waste, of water amounted to 5 cwt. for the six hours, the comparatively small loss being due to the fact that the waste of water is compensated by the double distilling apparatus which has been fitted on board.

The final trials for speed were made on Wednesday, the 12th February, under more favourable conditions of wind and weather than prevailed on the previous trials. Several runs were made upon the measured mile in Stokes Bay, when a mean speed of 19½ knots was obtained, being a gain of three-quarters of a knot upon what was realized at the three hours' trial. The *maximum* horse-power developed was 3100, the result of the complete run giving a mean collective power of 2800 horses, or 160 in excess of the contract, with an average of 322 revolutions.

FOREIGN
ARMOURED AND UNARMOURED SHIPS.

THE principal dimensions and other details of the ships in the following lists have been in many cases extracted from the Austrian *Marine-Almanach.* With few exceptions all details concerning the ships of any nation have been printed either in the naval periodicals or in the English newspapers, and in those of foreign countries. Where the latter sources of information failed, the deficiency has been made up from the *Navy Estimates* submitted to the several national Parliaments, and from other public official documents. It would have been impossible in every case to note the source from which each detail was derived without overburdening the pages with references and adding enormously to the size of the book.

The alphabetical arrangement of the ships in each of the two great divisions, armoured and unarmoured, has been followed so as to facilitate reference. There being now no uniform system of classifying the ships of all nations, an attempt has been made to assimilate as far as possible the classification of foreign fleets to that adopted in the British *Navy List.* Occasionally this has been only approximately practicable, and it will be observed that the distinction between the smaller gun-*vessels* and the sea-going gun-*boats* is not always apparent, and the former term, applied by some nations to craft to which we apply the latter, has, for special reasons, been preserved.

The sketches of the ships are all drawn on the same scale (except in a few cases specially named), so that their relative sizes are apparent by inspection.

The designation of foreign guns by *centimetres* of calibre will permit easy reference to the Tables of Ordnance of the several powers. In general, it may be stated that, as every nation is engaged in either replacing its naval ordnance with new and improved pieces, or in re-arranging the armament of individual ships, it has been only possible to republish the latest accessible information on the subject. The machine gun and torpedo armaments of any fleet vary continually.

ABBREVIATIONS.

A list of Abbreviations of the several classes of ships and vessels is placed at the head of each Table. The following refer to armaments throughout:—

B.L.R.	Breech-loading rifled gun.	
M.L.R.	Muzzle „ „ „	
l.	Light gun.	
M.	Machine gun.	
Q.F.	Quick-firing gun.	
f. tu. l. car.	Fixed torpedo tube or launching carriage for Whitehead Torpedoes.	
P.	Deck protected throughout.	The protective decks in all cases are at least one inch thick.
pp.	Deck protected amidships.	

ARGENTINE REPUBLIC.—Armoured Ships.

c.b., central-battery ship; *c.s.t.*, coast-service turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Endurance.	
					Belt.	Battery.					Guns.	Fish Torpedo Dischargers				Coals that can be carried in Bunkers.	At ten knots.
		Tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.b.	**Almirante Brown** (steel)	4200	240 0	50 0	9 (comp.)	8 (comp.)	11 & 8	20 6	2	4500	8 8-in. 11½-ton B.L.R., 6 4½-in. do. (Armstrong) 4 M.	..	1880	..	13·75	650	4300
c.s.t	**Andes**	1535	186 0	44 0	6	8 (turret)	11⅞	9 6	2	750	2 12½-ton Armstrong M.L.R., in turret, 2 lt. and 4 M.	..	1875	..	9·05	120	2880
„	**Plata**	1535	186 0	44 0	6	8 „	11⅞	9 6	2	750	2 12½-ton Armstrong B.L.R., in turret, 2 l.	..	1874	..	9·05	120	2880

It is understood that a second ship of the Almirante Brown type, and of nearly the same dimensions, is now in course of construction.

ARGENTINE REPUBLIC.—Unarmoured Ships.

cr., cruiser; *g.v.*, gun-vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Endurance.	
									Guns.	Fish Torpedo Dischargers				Coals that can be carried in Bunkers.	At ten knots.
			ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
cr.	**Patagonia** . .	1530	220 0	32 10	Steel & wood	12 9	2	2400	1 10-in. B.L.R., 3 6-in. do., 6 l., 10 M. .	..	1885 at Trieste.	..	14·00	350	—
g.v.	**Parana** . . .	550	142 8	25 0	Iron	11 9	1	475	2 6½-ton M.L.R., 2 lt.	..	1874	..	11·0	—	—
„	**Uruguay** . .	550	142 8	25 0	Iron	11 9	1	475	2 6½-ton M.L.R., 2 lt.. . . .	..	1874	..	11·0	—	—

4 *Gunboats (Rendel type)*, 416 tons, 420 I.H.P.; 4 *1st class Torpedo boats (for Whiteheads)*; 4 *Spar Torpedo boats*; 1 *paddle Torpedo vessel*, Maipu; 7-*screw steam vessels*; 6 *paddle-wheel vessel*, besides steam transports, and a sailing Corvette of 650 tons.

AUSTRIA.—Armoured Ships.

b., barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship; *c.s.*, coast service ship; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Endurance.	
							Belt.	Battery or Turret.						Guns.	Fish Torpedo Dischargers				Coals that can be carried in Bunkers.	At 10 knots.
		Tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
c.b.	**Archduke Albert** (iron)	5940	285	2	56	3	9	7	9½	22	0	1	4060	8 24-c.m. B.L.R. 15½-ton Krupp, 6 9 c.m. Uchatius, 6 M., 2 l.	..	1872	357,600	13·00	453	1472
b.	**Archduke Ferdinand Max** (wood)	5060	262	0	52	6	5	5	..	23	6	1	3500	14 18-c.m. Krupp, B.L., 4 9-c.m. Uchatius, 5 M., 2 l.	..	1865	..	12·50	330	—
b.	**Crown Prince Rudolph** (2) (steel)	6900	295	0	62	4	12	11	..	25	3	2	6500	3 30½-c.m. (35 cals.) 48-ton Kr., 6 9 c.m. Uchatius, 6 M., 2 l.	..	Bldg. at Pola.	330,000	14·00	600	—
c.b.	**Custoza** . (iron)	7060	302	3	58	0	9	7	8¼	24	6	1	4820	8 26-c.m. 22-ton Krupp, 6 9 c.m. Uchatius, 6 M., 2 l.	..	1872	414,400	14·00	584	1624
c.b.	**Don Juan de Austria** (iron)	3550	240	3	50	0	8	6	9¾	20	0	1	2920	8 21-c.m. 10-ton Krupp, 4 9 c.m. Uchatius, 6 M., 2 l.	..	1875	..	13·50	380	2000
br.	**Habsburg** (wood)	5140	262	0	52	0	5	5	27⅞	23	9	1	3500	14 7-in. 6½-ton M.L.R. Armstrong, 4 9-c.m. Uchatius, 5 M., 2 l.	..	1865	280,672	12·00	330	—
c.b.	**Kaiser** . (wood)	5810	254	0	58	3	6	5½	31	24	3	1	3200	10 9-in. 12-ton Armstrong M.L.R., 6 9-c.m. Uch., 6 M., 2 l.	..	1871	337,200	13·00	450	1519
c.b.	**Kaiser Max** (iron)	3550	240	3	50	0	8	6	9¾	20	0	1	2890	8 21-c.m. 10 ton Krupp, 4 9 c.m. Uchatius, 6 M., 2 l.	..	1875	211,600	13·00	380	2000
c.b.	**Lissa** . (wood)	6080	288	3	56	9	6	5½	30	26	0	1	4200	12 24-c.m. 15½-ton Krupp, 4 9 c.m. Uchatius, 6 M., 2 l.	..	1869	412,800	13·00	490	1420
c.b.	**Prince Eugene** (iron)	3550	240	6	50	0	8	6	9¾	20	0	1	2960	8 21-c.m. 10-ton Krupp, 4 9 c.m. Uchatius, 6 M., 2 l.	..	1877	..	13·00	380	2000
b.	**Princess Imperial Stefanie** (was Archduke Ferdinand Max) (1) (steel)	5150	278	10	55	9	9	8	..	21	6	2	6500	2 30½-c.m. (35 calibs.). 48-ton Krupp, 6 15 c.m. (35 cals.) 5-ton Krupp, 6 M., 2 l.	..	1887	300,000	15·00	400	—
c.b.	**Tegetthoff** (iron & steel)	7390	286	11	71	1	14	14	9¾	24	10	1	6500	6 28-c.m. 27-ton Krupp, 6 9 c.m. Uchatius, 6 M., 2 l.	..	1878	?247,378	14·00	670	3300
River Monitor	**Leitha** (iron & steel)	310	166	0	27	6	1¾	2½ (turret)	7½	3	7	2	320	2 15-c.m. Wahrendorf, 1 M.	..	1871	20,000	8·00	20	—
"	**Maros** (iron & steel)	310	166	0	27	6	1¾	2½ (turret)	7½	3	7	2	320	2 15-c.m. Wahrendorf, 1 M.	..	1871	20,000	8·00	20	—

AUSTRIA.—Unarmoured Ships.

corv., corvette; *fr. cr.*, frigate-built cruiser; *g. v.*, gun-vessel; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at knots.
												Guns.	Fish Torpedo Dis-chargers					
		Tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
g. v.	**Albatross**	570	150	11	26	3	wood	11	2	1	580	2 15-c.m. 3-ton Wahrendorf, 1 l.	..	1873	..	10·00	60	—
fr. cr.	**Archduke Frederic**	1570	173	10	39	5	wood	16	9	1	780	14 15-c.m. 3-ton Wahrendorf, 1 l.	..	1874	..	9·00	200	—
corv.	**Aurora**	1340	190	6	32	10	composite	16	1	1	1170	4 15-c.m. 3-ton Wahrendorf, 1 l.	..	1873	..	11·00	160	—
fr. cr.	**Donau**	2510	233	4	42	8	wood	19	8	1	1430	11 15-c.m. 5-ton Krupp, 1 l.	..	1874	..	12·00	320	—
Torpedo vessel.	**Seehund**	1550	224	0	34	0	steel	14	0	2	6200	2 12-c.m. 2¼-ton Krupp, 10 Q.F. & M.	4 tu. or l.car	1886	..	18·50	250	—
corv.	**Fasana**	1970	223	3	39	5	wood	16	9	1	1750	4 15-c.m. 5-ton Krupp, 1 l.	..	1870	..	12·00	315	—
„	**Frundsberg**	1840	190	6	32	10	composite	16	1	1	1260	4 15-c.m. 3-ton Wahrenrdorf, 1 l.	..	1873	..	11·00	160	—
„	**Helgoland**	1820	226	6	36	2	wood	16	9	1	1860	5 15-c.m. 7-ton Krupp, 1 l.	..	1867	..	12·00	230	—
g. v.	**Hum**	900	173	10	29	6	wood	12	6	1	920	4 15-c.m. 3-ton Wahrendorf, 1 l.	..	1861	..	13·00	150	—
„	**Kerka**	540	146	8	26	3	wood	11	2	1	300	2 15-c.m. 8-ton Wahrendorf, 1 l.	..	1860	..	9·00	50	—
fr. cr.	**Laudon**	3430	253	0	46	0	composite	20	8	1	2850	15 15-c.m. 5-ton Krupp, 2 l.	..	1873	..	13·00	450	—
Torpedo cruiser	**Leopard** (3)	1550	224	0	34	0	steel	14	0	2	6200	2 12-c.m. (25 cal.) 2¼-ton Krupp, 10 Q.F. & M.	4 tu. or l.car	1886	200,000	18·30	250	—
„	**Lussin**	913	200	4	26	3	steel	12	2	2	2600	2 15-c.m. (35 cal.) 5-ton Krupp, 2 M., 1 l.	..	1883	..	14·00	200	—

AUSTRIA.—Unarmoured Ships—*continued.*

corv., corvette; *fr. cr.*, frigate-built cruiser; *g. v.*, gun-vessel; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at knots.
												Guns.	Fish Torpedo Dis-chargers					
		Tons.	ft.	in.	ft.	in.		ft.	in.						£	Knots.	tons.	knots.
Torpedo cruiser	**Meteor** (3)	1550	224	0	34	0	steel	14	0	2	6200	2 12-c.m. 2½-ton B.L.R. Krupp, 10 Q.F. & M.	4 f. tu. or l.car	Bldg.	..	18·50	250	—
g. v.	**Narenta**	540	147	8	20	3	wood	11	2	1	310	2 15-c.m. 3-ton Wahrendorf, 1 l.	..	1860	..	9·00	50	—
"	**Nautilus**	570	150	11	26	3	wood	11	2	1	410	2 15-c.m. 3-ton Wahrendorf, 1 l.	..	1873	..	9·00	60	—
Torpedo cruiser	**Panther** (3)	1550	224	0	34	0	steel	14	0	2	6200	2 12-c.m. (35 cal.) 2½-ton Krupp, 10 Q.F. & M.	4 f. tu. or l.car	1885	..	18·50	250	—
fr. cr.	**Radetzky**	3430	253	0	46	0	composite	20	8	1	3400	15 15-c.m. 5-ton Krupp, 2 l.	..	1872	..	14·00	450	—
"	**Saida**	2440	233	4	42	8	wood	19	1	1	2010	11 15-c.m. 5-ton Uchatius, 1 l.	..	1878	..	12·00	320	—
g. v.	**Sansego**	350	111	7	23	0	wood	9	0	1	290	2 15-c.m. 3-ton Wahrendorf	..	1861	..	9·00	45	—
Torpedo vessel.	**Sebenico**	880	187	0	26	3	steel	12	2	2	2600	4 9-c.m. Uchatius, 2 M., 1 l.	..	1882	..	14·00	200	-
"	**Spalato**	840	179	6	26	3	steel	12	2	2	2600	4 9-c.m. Uchatius, 2 M., 1 l.	..	1870	..	14·00	150	—
"	**Zara**	840	179	6	26	3	steel	12	2	2	2600	4 9-c.m Uchatius, 2 M., 1 l.	..	1879	..	14·00	150	—
corv.	**Zrinyi**	1340	190	6	32	10	composite	16	1	1	1170	4 15-c.m. 3-ton Wahrendorf, 1 l.	..	1871	..	11·00	160	—

Paddle-wheel vessels, Andreas-Hofer, Greif, Taurus, Trieste; and two gun-boats, the Gemse and Grille, of 320 tons displacement and 360 indicated horse-power; also Yachts, Harbour Service and Training Ships, Transports, &c.

Torpedo boats, Adler, Falke, Habicht, and Sperber, of 135 ft. in length, 13 ft. 7 in. broad, displacement 87 tons, speed 22 knots, indicated horse-power 850, coals carried 28 tons; *twenty-six* of from 40 to 60 tons displacement, and 400 to 600 horse-power; and *eight* of 10 to 30 tons displacement, 200 to 300 horse-power, and 18 knots.

NOTES ON THE AUSTRIAN NAVY.

(1) ARMOURED AND UNARMOURED SHIPS.

Archduke Ferdinand Max, now Princess Imperial Stefanie.

The coast-defence twin-screw ironclad, Archduke Ferdinand Max, was launched at San Rocco, near Trieste, on 14th April, 1887, and is now completing for sea there. She will take the place of the old broadside ironclad of the same name; she was laid down in 1884, and is built throughout of steel. Her principal dimensions are:—Length, 278 ft. 10 in.; breadth, 55 ft. 9 in.; draught of water, 21 ft. 6 in.; displacement, 5150 tons. She has a complete belt of steel armour 9 in. thick, an oval-shaped barbette tower covered with 8-in. steel armour, a complete steel protective deck over the top of the belt, and steel shields for all the guns. The armament is to be two 12-inch (30½-c.m.) Krupp B.L. guns, six 5·9-in. (15-c.m.) ditto, six heavy machine guns, two light guns and Whitehead torpedo dischargers. The indicated horse-power of the engines is 6500, and the speed will be 15 knots. She will have two military masts, and her coal supply is 400 tons. The estimated cost of the ship complete is upwards of £300,000. The name of the ship has now been changed to Princess Imperial Stefanie.

(2) CROWN PRINCE RUDOLPH.

Crown Prince Rudolph.

This twin-screw coast-defence armourclad is now building at Pola Dockyard to replace the old broadside ironclad Salamander. She is larger than the Archduke Ferdinand Max, being 295 ft. long, 62 ft. 4 in. broad; mean draught of water, 25 ft. 3 in.; displacement, 6900 tons. She is built of steel throughout.

Her armour consists of a partial steel belt, 12 inches thick, with bulkheads; two oval-shaped barbette towers clad with 11-in. steel, and a complete protective deck of a maximum thickness of 2¾ in. All the guns have steel shields. The indicated horse-power of the engines is 6500, and the estimated speed 14 knots. The armament will consist of three 12-in. (30½-c.m.) Krupp B.L. guns in the barbette, six 3½-in. (9-c.m.) Uchatius B.L. guns, six Palmkrantz heavy machine guns and Whitehead torpedo dischargers. She will have one military mast. The supply of coal is 600 tons. The estimated cost is £330,000.

(3) METEOR.

Meteor.

In 1886 a torpedo cruiser similar to the Panther and Leopard, to be called the Meteor, was laid down at Pola Dockyard. She will be well advanced by the end of the current year—1887.

Panther and Leopard. The Panther and Leopard are described in *The Naval Annual* for 1886, at page 210.

TIGER.

The Tiger. A protected twin-screw cruiser of the most improved type was commenced early this year (1887). She is to be built of steel, and to have a displacement of 3800 tons.

BELGIUM.

Though Belgium has no Navy properly so called, there are about a dozen steam vessels, principally employed as packets, which are under the orders of the Government, and of which several would be found useful under certain conditions of naval warfare. Seven of these steamers are of 578 tons.

BRAZIL.—Armoured Ships.

c.b., central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Battery on Turret.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
River Monitor.	**Alagôas** . . (wood)	340	120	0	28	0	4½	4½ on turret	14½	4	10	2	180	1 70-pdr. Whitworth M.L.R.	..	1867	..	7·00		—
t.	**Aquidaban** (steel and wood sheathed)	4950	280	0	52	0	11 comp.	11½ comp., 10 comp. on turret	10	18	0	2	6200	4 9-in. 20-ton B.L.R. (Armstrong) 4 70-pdr. 5-ton do., 15 M.	5 f. tu. or l. car.	1885	345,000*	15·00	600	—
c.s., *t.*	**Bahia** . . (iron)	1000	178	0	35	0	4½	5½ on turret	10⅜	8	6	2	1640	2 7-in. M.L.R. (Whitworth) .	..	1865	..	10·00	—	—
c.s., *c.b.*	**Brazil** . . (iron)	1518	179	8	35	0	4½	4½ on turret	8	12	5	1	1500	4 7-in. M.L.R. (Whitworth), 4 68-pdr., 4 l., s b.	..	1864	60,000	11·30	—	—
t.	**Javary** . . (iron)	3700	240	0	58	0	12	13 on turret	9¾	11	5	2	2500	4 10-in. Whitworth M.L.R., 6 5-in. B.L.R., 5 M.	..	1875	..	11·20	200	680
c. s., *t.*	**Lima-Barros** . (iron)	1350	180	0	36	0	4½	4½ on turret	8¼	13	5	2	2100	4 7-in. Whitworth M.L.R. .	..	1866	..	12·00	200	—
cs., *c.b.*	**Mariz-e-Barros** (iron)	1444	198	10	36	0	4½	4½ on turret	8	10	10	2	600	4 7-in. Whitworth M.L.R. .	..	1866	..	9·00	—	—
River Monitor	**Piauhy** . . (wood)	340	120	0	28	0	4½	4½ on turret	14½	4	10	2	180	1 70-pdr. Whitworth M.L.R. .	—	1867	—	7·00	—	—
t.	**Riachuelo** (steel and wood sheathed)	5700	305	0	52	0	11 comp.	11 comp., 10 comp. on turret	10	19	6	2	7300	4 9-in. 20-ton B.L.R. (Whitworth, altered by Armstrong), 6 5½-inch 5-ton do., 15 M.	5 f. tu. or l. car.	1883	365,000*	16·71	800	4,500 (at 15 knots)
River Monitor	**Rio Grande** . (wood)	340	120	0	28	0	4½	4½ on turret	14½	4	10	2	180	1 70-pdr. Whitworth M.L.R. .	..	1864	..	7·00	—	—
c.b.	**Sete de Setembro** (wood)	2145	219	10	46	6	4½	4½	..	12	6	2	2000	4 9-in. 18-ton Whitworth M.L.R., 5 M.	..	1874	..	12·00	—	—
t.	**Solimões** . . (iron)	3700	240	0	58	0	12	13 on turret	9¾	11	5	2	2200	4 10-in. 25-ton Whitworth M.L.R., 5 M.	..	1875	—	11·20	200	680

* Exclusive of guns and ammunition.

NOTE.—The Brazil and Lima-Barros are now used as Stationary Floating Batteries.

BRAZIL.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *g.v.*, gun-vessel; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Fish Torpedo Dis-chargers	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
cr.	**Almirante Barroso**	1960	213	5	36	2	composite	17	5	1	2200	7 5½-in. Whitworth B.L.R., 4 M.	..	1882	..	12·00	—	—
corv.	**Guanabàra**	1900	200	0	41	2	wood	16	4	1	3000	9 70-pdr. Whitworth, 6 M.	..	1877	..	14·00	—	—
cr.	**Imperial Marinheiro**	726	167	0	26	3	composite	11	0	1	750	6 12-c.m. B.L.R., 1 9-c.m. do., 4 M.	..	1883	..	9·00	—	—
corv.	**Nictheroy**	1800	192	0	41	0	wood	16	0	1	1000	14 70-pdr. Whitworth, 6 M.	..	1862	..	8·00	—	—
”	**Parnahyba**	838	170	6	26	3	composite	11	2	1	900	1 70-pdr. Whitworth 6 lt.	..	1878	..	10·00	—	—
cr.	**Primeiro de Março**	726	167	3	26	3	composite	10	6	1	750	7 4½-in. Whitworth, B.L.R., 4 M.	..	1881	..	9·00	—	—
g.v.	**Rio Sado**	550	151	0	29	6	composite	11	6	1	500	1 18-c.m. Armstrong B.L.R., 4 12-c.m. do.	..	1884	..	11·00	—	—
cr.	**Trajano**	1400	210	2	29	6	wood	14	9	1	2400	7 4½-in. Whitworth B.L.R., 4 M.	..	1873	..	13·00	—	—
corv.	**Vital de Oliveira**	1402	203	7	36	1	wood	13	2	1	1000	4 70-pdr. Whitworth	..	1867	—	—	—	—

Double-screw gunboats.—Guarany, Forte de Coïmbra, Iniciadora, Pedro Affonso, Traripe, 250 to 330 tons; 160 to 260 I.H.P.

River-service gunboats. — Cabedello, Camocim, Cananéa, Carioca Marajó.

Paddle river-service gunboats.—Braconnot, Greenhalg, Henrique Martins, Lamego, Manáos, Taquary.

Paddle steamers.—Amazonas, Felippe Camarão, Fernandes Vieira, Henrique Diaz, Paraense, Tramandahy, Vidal de Negreiros.

Torpedo boats.—Four first-class, built in England in 1882, of 110 ft. in length, and 12½ ft. in breadth, indicated horse-power 600, and speed 20 knots; sixteen of smaller size.

Also Training and Harbour Ships and Transports.

BULGARIA.

This principality is already in possession of the nucleus of a naval force in a flotilla of eleven steamers of small size, of which one is the Prince's Yacht.

CHILI.—Armoured Ships.

c. b., central-battery ship; *t.*, turret ship.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Battery.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
c.b.	**Almirante Cochrane** (iron)	3500	210	0	45	9	9	8	7¾	19	8	2	2920	4 9-in. B.L.R. 18-ton Arm., 2 7-in. B.L.R.A. 7 M., 4 l.	..	1874	..	13·00	500	1900
c.b.	**Blanco Encalada** (iron	3500	210	0	45	9	9	8	7¾	19	8	2	2920	6 12-ton Armstrong M.L.R., 7 M., 4 l.	..	1875	..	12·00	500	1900
t.	**Huascar** . . (iron)	1800	200	0	35	0	4½	5½ on turret	14	15	6	1	1050	2 10-in. 12½-ton Armstrong M.L.R., 2 40 pdr., 2 l.	..	1865	..	12·00	200	—

CHILI.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; P., deck protected throughout.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
corv.	**Abtao** . . .	1050	227	0	29	6	composite	15	6	1	300 (nom.)	1 70-pr. B., 4 40-pr. B. Armstrong, 4 M.	..	1864	..	9·00	—	—
"	**Chacabuco** . .	1101	218	6	33	4	wood	17	4	1	1200	3 8-in., 2 70-pdrs., 4 40-pdr. (all B.L.R. Armstrong)	..	1866	..	10·00	400	—
cr.	**Esmeralda P** . .	3000	270	0	40	0	steel	18	3	2	6500	2 10 in. 25-ton Armstrong B.L.R., 6 6-in. 4-ton. do., 2 Q.F., 6 M.	3 f tu. or l.car	1884	..	18·28	600	2200
corv.	**Magellanes** . .	800	190	0	28	0	composite	14	9	2	1230	1 7-in. B., 1 64-pdr., 3 l. . . .	..	1874	..	11·00	—	—
"	**O'Higgins** . .	1100	218	6	33	4	wood	17	4	1	1200	3 7-in. B., 4 40-pdr. B. (all Armstrong)	..	1866	..	10·00	—	—
"	**Pilcomayo** . .	600	171	0	27	4	wood	..		1	180 (nom.)	2 70-pdr., 2 40-pdr., 2 l. . .	..	1874	..	9·00	—	—

For particulars of the construction of the Esmeralda, see page 216 of *The Naval Annual* for 1886.

Gunboats.—Five.
Torpedo boats.—Eleven.

Despatch Vessel.—Amazonas.
Transport.—Angamos.

CHINA.—Armoured Ships.

(The Chinese Navy is divided into Provincial Fleets: Canton, Foo-chow, Shang-hai, Peiho, and North Coast.)
a.g.b., armoured gunboat; *b.*, barbette ship; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.		Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
								B.lt.	Turret.						Guns.	Fish Torpedo Dis-chargers					
			tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
b.	**Chen-Yuen** .	(steel)	7430	308	5	59	0	14 comp.	12 comp.	14	20	0	2	6200	4 30½-c.m. Krupp, 2 15-c.m. do., 8 M., 2 l.	2 l. car.	1882	..	14·50	1000	—
b.	**King-Yuen** (1) .	(steel)	2850	270	0	40	0	9½	8 comp.	3-in. steel dk.	16	6	2	3400	2 8¼-in. 10-ton B.L.R., 2 6-in. do., 7 M.	1 f.tu.sb. 3 l. car.	1887	..	16·50	325	—
b.	**Lai-Yuen** (1) .	(steel)	2850	270	0	40	0	9½	8 comp.	3-in. steel dk.	16	6	2	3400	2 8¼-in. 10-ton B.L.R., 2 6-in. do., 7 M.	1 f.tu.sb. 3 l. car.	1887	..	16·50	325	—
b.	**Ting-Yuen** .	(steel)	7430	308	5	59	0	14 comp.	12 comp.	14	20	0	2	6200	4 30½-c.m. Krupp, 2 15-c.m. do., 8 M., 2 l.	2 l. car.	1881	..	14·50	1000	—
a.g.b.	**Tien-Sing** .	(wood)	195	105	0	20	4	1⅛	3	5	7	0	2	340	1 17-c.m. Krupp . . .	..	1875	..	10·0	—	—

CHINA.—Unarmoured Ships.

cr., cruiser; *fr. cr.*, frigate-built cruiser; *g.v.*, gun-vessel; P., deck protected throughout; *pp*, partial deck protected; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
cr.	**Chih-Yuen** P. (2).	2300	250	0	38	0	steel	15	0	2	5500	3 8-in. 12-ton B.L.R., 2 6-in. 4-ton. do.	4 f. tu. or l.car	1887	..	18·00	450	—
”	**Ching-Yuen** P. (2).	2300	250	0	38	0	steel	15	0	2	5500	3 8-in. 12-ton B.L.R., 2 6-in. 4-ton. do.	4 f. tu. or l.car	1887	..	18·00	450	—
fr. cr.	**Hai-An**	2030	300	0	42	0	wood	21	0	1	1750	2 21-c.m. Krupp, 4 15-c.m. do., 20 12-c.m. do.	..	1872	..	12·00	—	—
g.v.	**Mei-Yun**	578	170	0	22	9	composite	9	2	1	400	1 16-c.m. Vavasseur, 2 12-c.m. Vavasseur	..	1869	..	8·00	—	—
cr.	**Nan-Schuin**	2200	253	0	36	2	steel	18	1	1	2400	2 8-in. Armstrong B.L.R., 8 4½-in. do.	..	1884	..	15·00	—	—
”	**Nan-Thin**	2200	253	0	36	2	steel	18	1	1	2400	2 8-in. Armstrong B.L.R., 8 4½-in. do.	..	1883	..	15·00	—	—
”	**Tshao-Yong** *pp*	1350	210	0	32	0	steel	15	8	2	2677	2 10-in. Armstrong B.L.R., 4 4½-in. do., 6 M., 2 l.	..	1881	..	16·80	300	5380 (at 8 knots)
g.v.	**Tshen-Hai**	578	160	10	26	3	wood	10	6	1	480	1 6½-ton Armstrong M.L.R., 6 l.	..	1872	..	10·00	—	—
cr.	**Tshi-Yuen** P.	2355	236	3	34	5	steel	15	9	2	2800	2 21-c.m. (35 calibre) Krupp, 1 15-c.m. do., 4 l., 6 M.	4 tu.	1886	..	15·00	230	—
g.v.	**Tsing-Yuen**	578	160	10	26	3	wood	10	6	1	480	1 6½-ton Armstrong M.L.R., 6 l.	..	1872	..	10·00	—	—
cr.	**Yang-Pao**	2200	253	0	36	2	composite	18	1	2	2400	3 8-in. 10-ton B.L.R., 7 4¾-in. do.	..	1883	..	15·00	—	—
”	**Yang-Wai** *pp*	1350	210	0	32	0	steel	15	8	2	2580	2 10-in. Armstrong B.L.R., 4 4½-in. do., 6 M., 2 l.	..	1881	..	16·00	300	5370 (at 8 knots)
”	**Ye-Sing**	2500	253	0	36	0	composite	15	6	1	2400	3 8½-in. 10-ton B.L.R., 7 4¾-in. do.	..	Bldg.	..	15·00	—	—

Cruisers.—One, of the Nan-Schuin and Nan-Thin type, is being built at Foo-chow, and one at Kiang-nan near Shang-hai; two, of 1600 tons and 2000 horse-power, are also now in course of construction.

Gunboats (*Rendel's System*).—Eleven of 325 to 440 tons displacement; 235 to 440 indicated horse-power, named with letters of Greek alphabet

Gunboats (*Canton Flotilla*).—Thirteen of 100 to 350 tons displacement.

Floating Batteries.—Six with wooden fixed turrets for river service.

Torpedo boats.—Twenty-one First-class, of which one is 160 ft. long, 19½-ft. broad, of 1500 horse-power, and 23 knots speed, and nine Second-class.

NOTES ON THE CHINESE NAVY—ARMOURED AND UNARMOURED SHIPS.

(1) KING YUEN AND LAI YUEN.

King Yuen and Lai Yuen.

Two small twin-screw barbette ships, partially armour-belted and intended for coast defence, but capable of making extended passages at sea, called the King Yuen and Lai Yuen, were laid down for the Chinese Government by the Vulcan Company, in Stettin, and were launched, the first on 3rd January, 1887, and the last on the 25th March, 1887. They were completed in the summer of 1887, and left England in September this year, in company with the two protected cruisers Chih Yuen and Ching Yuen, built at Elswick, and a torpedo boat of the first class built by Yarrow.

The armour is compound, and consists of a belt for protection of the engine and boiler rooms from 2 ft. above the water-line to 4 ft. below it, and is 9½ in. to 5¼ in. thick. This belt is terminated by transverse bulkheads 8 in. thick. There is a protective deck over the belt 1½ in. thick. The deck is 3 in. thick at the extremities, and dips down as usual. There is a circular barbette forward protected by 8-in. compound armour. A strong steel shield extends over the barbette. There is a conning tower abaft and above the barbette which is protected by 6-in. armour. There is a double bottom extending about two-thirds of the length of the ship, and it is divided into 66 separate water-tight compartments. Before and abaft the belt the space between the protective deck and the deck above is divided into water-tight compartments, of which those next the ship's side are packed with cork. The armament consists of two (21-c.m.) Krupp B.L. guns in the barbette; two (15-c.m) 5·9-in. guns of the same description; seven machine guns; and four Schwartzkopff torpedo dischargers, one in the bow under water, and three above water. She has one military mast.

The principal dimensions of the ship are:—Length, 270 ft.; breadth, 40 ft.; extreme draught, 16 ft. 6 in.; displacement, 2850 tons. The engines are triple expansion, and develop 3400 horse-power, giving a speed of 15½ knots with natural draught, and a speed of 16½ knots with forced draught. The boilers are cylindrical, and four in number. The coal stowage is 325 tons. The ammunition carried for the large guns is 50 rounds for each gun.

(2) Chih Yuen and Ching Yuen.

Chih Yuen and Ching Yuen.

Two twin-screw steel-protected cruisers were laid down at Elswick in October, 1885, for the Chinese Government. The first was launched on 29th September, 1886, and the second on the 14th December, 1886. They were completed in every respect by the summer of 1887, and left England in September, 1887, in company with the two iron ships King Yuen and Lai Yuen, built at Stettin, and a torpedo boat.

Their length is 250 ft.; breadth, 38 ft.; draught of water, 15 ft.; and their displacement is 2300 tons. The engines are triple expansion, and they develop 5500 horse-power, and the estimated speed is 18 knots.

The armament consists of two 8-in. 12-ton B.L.R. guns forward, and one gun of the same size and description aft; two 6-in. 4-ton B.L.R. guns on the broadside with quick-firing and machine guns, and four Whitehead torpedo dischargers.

Fee Chen.

Fee Chen.

A small steel cruiser, built by Messrs. Doxford, of Sunderland, was launched on 20th April, 1887. She carries an armament of two 6-in. Armstrong B.L. guns and four light guns. She is also to be fitted as a cable steamer. The engines are triple expansion, and the speed of the vessel is expected to be 13 knots.

Sea-going Torpedo Boat.

A first-class torpedo boat, built for the Chinese Government, left Elbing, Prussia, in June, and was taken out under her own steam to Foochow, in China. This boat has a deck length of 144 ft. 4 in., a width of 16 ft. 5 in., and a draught of 7 ft. 2½ in. It steamed the distance from Elbing to Dartmouth in 3 days 5 hours, Dartmouth to Lisbon in 2 days 9 hours, Lisbon to Gibraltar in 9 hours, and from Gibraltar, without any intermediate stoppage, it steamed to Port Said in 7 days and 4 hours. The next stage was to Aden in 5 days two hours, and thence to Colombo in 8 days and 2 hours.

During the whole of the run the boat, with all her fittings, behaved admirably.

On her trial trips, the average speed accomplished during one hour's run with coals for 1000 knots on board was 24·23 knots.

DENMARK.—Armoured Ships.

b.c., belted cruiser; *br.*, broadside ship; *c.s.*, coast-service vessel; *t.*, turret ship; f.tu., fixed tubes, and l. car., launching carriages for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Battery or Turret.						Guns.	Fish Torpedo Dischargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
b.c.	**Absalon** . . (iron)	527	150	0	26	0	2	2	6	10	2	1	500	6 8·7 in. Krupp, 2 M. . .	..	1862	..	10·00	65	—
br.	**Denmark** . . (iron)	4747	270	0	49	6	4½	4½	18	19	10	1	1007	12 8-in. Armstrong M.L.R., 12 6-in. Finspong M.L.	..	1864	260,000	8·00	625	—
Torpedo School Ship	**Esbern Snare** . (iron)	527	150	0	26	0	2½	2½	6	10	2	1	500	2 M.	1 f. tu. or l.car	1862	..	10·00	—	—
c.s., t.	**Gorm** . . . (iron)	2344	231	0	40	0	7	8 turret	10	14	0	2	1670	2 10-in. 18-ton Armstrong M.L.R., 3 8-7-c.m. Krupp, 4 M.	..	1870	104,000	12·25	115	—
t.	**Helgoland** . . (iron)	5347	257	6	59	2	12	10	10	18	8	2	4000	1 30½-c.m. 36-ton Krupp, 4 26-c.m. 22-ton do., 5 12½-c.m. do.	4 f. tu. or l.car	1878	275,000	12·00	230	1070
b.	**Iver Hvitfeldt** (¹) (steel)	3260	242	0	49	6	12	8 on barbettes	..	18	0	2	5000	2 26-c.m. 28-ton Krupp, 6 12-c.m. do., 10 M.	4 f. tu. or l.car	1885	200,000	15·60	250	—
c.s., t.	**Lindormen** . . (iron)	2076	216	0	39	5	5	5 turret	9¾	13	9	2	1560	2 9-in. 13-ton Armstrong M.L.R., 3 8·7-c.m. Krupp 4 M.	..	1868	93,000	12·00	120	—
c.b.	**Odin** . . . (iron)	3083	237	0	50	0	8	8	10	15	6	1	2260	4 10-in. 18-ton Armstrong M.L.R., 4 8·7 c.m. Krupp B.L.R., 6 M.	..	1872	147,000	12·40	180	560
br.	**Peder Shram** . (wood)	3373	220	0	48	5	5	4½	..	20	7	1	1680	8 8-in. Armstrong M.L.R., 8 6-in. Finspong, & 12·26 do.	..	1864	..	11·70	300	1589
t.	**Rolf Krake** . . (iron)	1344	185	2	38	3	4½	4½	9	10	6	1	750	2 8 in. Armstrong, 2 8·7 c.m. Krupp 4 M. . . .	..	1863	74,000	7·80	135	—
Torpedo Ship	**Tordenskiold** . (steel)	2400	221	6	43	3	Armour on deck 4 in. to 2 in.	8 (steel)	..	15	6	2	2600	1 30½-c.m. 52-ton Krupp, 4 12-c.m. do., 6 M.	4 f. tu. or l.car	1880	138,900	14·00	170	—

DENMARK.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *fr. cr.*, frigate-built cruiser; *g.v.*, gun-vessel; P., deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Torpedoes.	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
corv.	**Dagmar** . . .	1193	173 10	33 10	wood	16 0	1	800	14 5½-in. 4¾-ton Krupp, 2 M. .	..	1861	50,000	9·50	150	—
g.v.	**Diana**	556	154 6	26 3	wood	10 2	1	500	6 8·7-c.m. Krupp, 2 M. . .	..	1863	33,000	9·00	60	—
„	**Falster** . . .	356	111 0	28 10	iron	7 6	2	510	1 10-in. 20-ton Armstrong M.L.R., 2 8·7-c.m. Krupp, 2 M. . .	..	1873	33,000	9·80	20	—
fr. cr.	**Fyen** . . . P.	2596	226 6	45 6	steel and iron wood sheathed	18 1	1	2700	4 long 15-c.m. 4¾-ton Krupp, 14 15-c.m. 3½-ton short do., 6 M.	2 f. tu. or l. car	1882	170,000	13·00	290	—
g.v.	**Fylla**	556	154 0	26 3	wood	10 2	1	500	6 8·7-c.m. Krupp, 2 M. . .	..	1862	33,000	9·00	60	—
corv.	**Heimdal** . . .	1192	173 10	31 6	wood	16 0	1	750	14 5½-in. Finspong, 2 M. . .	..	1856	..	9·00	—	—
g.v.	**Ingolf**	870	192 0	28 0	iron	12 6	1	670	3 15-c.m. Krupp, 2 M. . .	..	1876	44,000	10·50	130	—
fr. cr.	**Jylland** . . .	2457	200 3	44 3	wood	19 5	1	1350	20 6-in. Finspong M., 6 12-c.m. Krupp, 4 M.	..	1860	84,000	11·00	260	—
g.v.	**Moen**	356	111 0	28 10	iron	7 6	1	523	1 10-in. 20-ton Armstrong M.L.R., 2 8·7-c.m. Krupp, 2 M.	..	1875	..	9·20	20	—
corv.	**Saint Thomas** . .	1572	224 0	33 0	wood	17 0	1	1870	1 8-in. 9-ton Armstrong M.L.R., 4 12-c.m. Krupp, 3 M.	..	1871	..	13·00	190	—
cr.	Valkyrien* (²) . P.	2900	268 0	43 6	steel	18 0	2	5000	2 long 21-c.m. 10-ton Krupp, 6 15-c.m. long 4¾-ton Krupp, 10 M.	5 f. tu. or l. car	1887	..	17·00	450	—

* 2¼ ins. steel deck under water through the whole length of the ship.

Gunboats.—Nine in number, of 150 to 240 tons; 200 to 400 indicated horse-power.

Torpedo boats.—Two sea-going, of 85 tons, and 1000 indicated horse-power; *first class*, five, and five to be built; *second class*, nine, and thirteen to be built.

In addition there is a Royal Yacht and a Transport.

NOTES ON THE DANISH NAVY.—ARMOURED AND UNARMOURED SHIPS.

(1) IVER HVITFELDT.

Iver Hvitfeldt.

The Iver Hvitfeldt, briefly described on page 223 of *The Naval Annual* for 1886, was launched 14th April, 1886. She completed her steam trials in May, 1887, when she obtained a maximum speed of 15·6 knots.

The ship is a double barbette ship, with a central casemate. The armour on the barbettes and hull is compound 12-in. maximum thickness. A steel protective deck 2-in. thick, which is flat between the barbettes and curved forward and aft, protects the vital portions of the ship. The armament consists of two 26-c.m. (10·3-in.) 28-ton Krupp B.L. guns in the barbettes, and six 5-in. Krupp B.L. in the casemate between the barbettes. There are also ten machine guns, and four Whitehead torpedo dischargers. The ship has twin screws, and compound engines developing 5000 horse-power.

(2) VALKYRIEN.

Valkyrien.

The protected twin-screw steel cruiser Valkyrien was laid down at Copenhagen on 1st November, 1886. Her principal dimensions are:—Length, 268 ft.; breadth, 43 ft. 6 in.; mean draught of water, 18 ft.; displacement, 2900 tons.

Her armament will be two 21-c.m. Krupp B.L. guns; six 15-c.m. guns of the same description; ten machine guns, and five Whitehead torpedo dischargers.

The engines are expected to develop 5000 horse-power, and the speed of the ship will be 17 knots. She will stow 450 tons of coal.

EGYPT.

Besides yachts, despatch vessels, and transports, there are on the list of the Egyptian Navy the following:—The Ibraichneih, a frigate of 4700 tons, 290 feet long, 50 feet broad, 19½ feet draught of water. The Mehemet Ali, a frigate of 1760 tons, 800 horse-power, and 28 guns. A wooden corvette, the Sakka, built in 1869, of 970 tons, 205 feet long, 37½ feet broad, 300 horse-power, and carrying 9 guns.

FRANCE.—Armoured Ships.

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship; **f. tu.**, **l. car.**, fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length at Water Line.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Battery or Turret.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
a.g.b. & b.	**Achéron*** (⁷) (steel)	1640	181	0	40	4	8	8	..	11	10	2	1700	1 27-c.m. 28-ton B.L.R., 2 10-c.m. do., 2 M.	..	1885	100,000	13·00	—	—
c.b.	**Alma** (*d*) . (wood)	3770	229	10	46	6	5⅞	4¾	26	23	11	1	1896	6 19-c.m. B.L.R., 4 12-c.m. do.	..	1867	101,200	11·89	—	—
b.	**Amiral Baudin** (iron & steel)	11,380	321	6	69	10	21½	16½ steel	14	26	2	2	6500 8320 forced draught.	3 37-c.m. (75 ton) B.L.R., 12 14-c.m. do., 8 M.	f. tu.	1883	600,000	15·00	800	3000
b.	**Amiral Duperré** (iron & steel)	11,100	311	0	66	11	21½	15½	14	26	9	2	5783 8000 forced draught.	4 34-c.m. (48 ton) B.L.R., 14 14-c.m. do., 12 M.	f. tu. or l. car.	1879	570,000	14·22	—	—
c.b.	**Atalante** (*d*) (wood)	3800	229	10	46	6	6	4¾	26	23	3	1	1640	8 19-c.m. B.L.R., 4 12-c.m. do., 6 M.	..	1868	..	11·43	—	—
b.	**Bayard** . (wood)	5881	265	9	57	2	10	8	15	24	11	2	4000	4 24 c.-m. 16-ton B.L.R., 2 19-c.m. 8-ton do., 6 14-c.m. 3-ton do., 12 M., 2 l.	..	1880	..	14·00	400	—
c.s., t.	**Bélier** . (wood)	3600	217	0	53	0	8½	7	31½	19	1	2	1921	2 24-c.m. 16-ton B.L.R. . .	..	1870	..	12·37	180	—
c.s.b.	**Belliqueuse** (*d*)(wood)	3706	230	0	46	3	6	4¾	26	22	10	1	1227	4 19-c.m. B.L.R., 4 16-c.m. do., 4 14-c.m. do., 6 M.	..	1865	99,176	11·78	—	—
c.s., t.	**Bouledogue** (wood)	3400	217	0	53	0	8½	7	31½	18	2	2	1827	2 24-c.m. 16-ton B.L.R. .	..	1872	..	12·25	180	—
b.	**Brennus** (⁸) (steel) (building suspended)	10,600	344	6	64	0	17½ comp.	17¼ comp.	..	26	9	3	5500	4 34-c.m. B.L.R., 8 14-c.m. do., 7 M.	..	..	..	15·00	—	—
c.s.b.	**Caiman** (⁸) (iron and (steel)	7230	278	3	59	0	19½	17¾	12	24	7	2	6000 8000 forced draught.	2 42-c.m. 75-ton B.L.R., 4 10-c.m. do., 4 M.	..	1885	..	14·50	500	—
c.s., t.	**Cerbère** . (wood)	3800	196	10	53	0	8½	7	31½	19	7	2	1800	2 24-c.m. 16-ton B.L.R. .	..	1868	137,600	11·39	—	—
b.	**Charles Martel** (steel) (bldng. suspended) (⁸)	10,650	344	6	64	0	17¼	17¼	..	26	9	3	5500	4 34-c.m. B.L.R., 8 14-c.m. do., 7 M.	..	..	..	15·00	—	—
a.g.b. & b.	**Cocyte** (⁷) . (steel)	1640	181	0	40	4	8	8	..	11	10	2	1700	1 27-c.m. 28-ton B.L.R., 2 10-c.m. do., 2 M.	..	1887	100,000	13·00	—	—

														24-c.m. 16-ton do., 6 41-c.m. 3-ton do., 8 M.						
c.b. & b.	**Courbet** (iron & steel), formerly called Foudroyant. (1)	9700	312	0	67	0	15	9½	..	25	0	2	8100	4 34-c.m. 48-ton B.L.R., 4 27-c.m. 28-ton do., 6 14-c.m. 3-ton do., 12 M.	4 f. tu. or l. car.	1882	800,000	14·20	628	3100
.b. & b.	**Dévastation** (iron & steel)	10,100	312	0	67	0	15	9½	12½	25	0	2	8320	4 34-c.m. 48-ton B.L.R., 4 27-c.m. 23-ton do., 6 14-c.m. 3-ton do., 8 M.	4 f. tu. or l. car.	1879	..	15·17	610	2800
b.	**Duguesclin** (6) (steel, sheathed with wood and coppered)	5869	266	0	57	0	9	8 barbettes compound	15	25	3	2	4100	4 24-c.m. 16-ton B.L.R., 1 19-c.m. 8 ton do., 6 14-c.m. 3-ton do., 2 Q.F., 12 M.	..	1883	220,000	14·00	400	—
.g.b. & b.	**Flamme** (3) . (special metal)	1045	165	0	32	7	10	4-in. shield	..	10	4	2	1500	1 24-c.m. 16-ton B.L.R., 1 9-c.m. do.. 2 M.	1 f. tu.	1885	68,000	13·00	50	—
c.b.	**Flandre** (*d*) . (wood)	5997	295	3	56	6	6	4¾	26	27	6	1	3536	8 24-c.m. B.L.R., 5 19-c.m. do., 6 M.	..	1864	213,280	13·30	—	—
b.	**Formidable** (steel)	11,441	319	4	68	3	21½	17¾	14	26	2	2	6500 8320 forced draught.	3 42-c.m. B.L.R., 12 14-c.m. 3-ton do., 8 M.	f. tu.	1885	467,520 hull, 85,800 machinery.	15·00	600	—
.b. & b.	**Friedland** . (iron)	8540	317	0	58	0	8	7	15	29	11	1	4428	8 27-c.m. 23-ton B.L.R., 8 14-c.m. 3-ton do., 8 M.	2 f. tu. or l. car.	1873	..	13·30	630	—
c.s., t.	**Fulminant** (iron and steel)	5574	248	0	57	9	13	12	16	21	4	1	3550	2 27-c.m. 23-ton B.L.R., 4 12-c.m. do., 4 M.	2 l.car.	1877	..	13·22	275	—
c.s., b.	**Furieux** (iron & steel)	5560	247	10	59	0	20	17¾	..	21	9	2	4000	2 34-c.m. 48-ton B.L.R., 4 10-c.m., 4 M.	..	1883	264,640	14·00	290	1500
.g.b. & b.	**Fusée** (3) (steel, wood sheathed & coppered)	1045	165	0	32	7	10	4-in. shield	..	10	4	2	1500	1 24-c.m. 16-ton B.L.R., 1 9 c.m. do., 2 M.	1 f. tu.	1884	68,000	13·00	50	—
„	**Grenade** (3) (steel wood sheathed & coppered)	1045	165	0	32	7	10	4-in. shield	..	10	4	2	1500	1 27-c.m. 16-ton B.L.R., 1 9-c.m. do., 2 M.	1 tu.	Bldg.	68,000	13·00	50	—
c.b.	**Héroine** . (iron)	5887	262	5	56	0	6	4½.	26	27	7	1	3318	8 24-c.m. 16-ton B.L.R., 3 19-c.m. 8-ton do., 2 14-c.m. 3-ton do., 3 12-c.m. do., 6 M.	..	1863	213,000	13·00	500	—
b.	**Hoche** (iron & steel) (4) & (5)	10,581	330	0	65	7	18	16	..	27	3	2	7000	2 34-c.m. 52-ton B.L.R., 2 27-c.m. 28-ton do., 18 14-c.m. 3-ton do., 8 M.	4 f. tu. or l. car.	1886	380,000 hull, 120,000 machinery	15·00	600	3500 at 11
rmoured ing battery	**Imprenable** (*d*) (iron) .	1420	129	6	51	10	5½	4¾	16	11	3	2	411	2 24-c.m. B.L.R., 2 16-c.m. do., 2 12-c.m. do.	..	1867	..	5·51	—	—

* The Achéron is ubilt of steel she has two screws, and an armoured belt at the water-line. Her 27-c.m. gun is carried on a barbette-turret.

(*d*) According to a statement made by the Minister of Marine in 1886, the eight ships so marked are condemned as unfit for further service at sea.

FRANCE.—Armoured Ships—*continued.*

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length at Water Line.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Battery or Turret.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
c.s., b.	**Indomptable** (2) (iron and steel)	7168	279	10	59	0	20	17½	..	23	6	2	6000	2 42-c.m. (75-ton) B.L.R., 4 10-c.m., 4 M.	..	1883	..	15·00	800	—
c.b. & b.	**La Galissonnière** (wood)	4700	255	8	49	0	6	4¾	26	23	9	2	2370	6 24-c.m. 16-ton B.L.R., 4 12-c.m. 3-ton do., 6 M.	..	1872	..	13·08	500	—
b.	**Magenta** (4) (iron and steel)	10,581	330	0	65	7	18	16	..	27	3	2	7000	2 34-c.m. 52-ton B.R.L., 2 27-c.m. 28-ton do., 20 14-c.m. 3-ton do., 20 M.	4 f. tu. or l. car.	Bldg.	380,000 hull, 120,000 machinery.	15·00	600	3500 at 11
b.	**Marceau** (5) (iron & steel)	10,581	330	0	65	7	18	16	..	27	3	2	7000	4 34-c.m. 52-ton B.L.R., 17 14-c.m. 3-ton do., 20 M.	4 f. tu. or l. car.	1887	380,000 hull, 120,000 machinery.	15·00	600	3500 at 11
c.b. & b.	**Marengo** . (wood)	7187	282	6	56	10	8	6¼	32	27	8	1	3673	4 27-c.m. 27-ton B.L.R., 4 24-c.m. 16-ton do., 7 12-c.m. do., 12 M.	..	1869	280,000	13·49	650	—
a.g.b. & b.	**Mitraille** (6) (steel, wood sheathed and coppered)	1045	165	0	32	7	10	4-in. shield	..	10	4	2	..	1 27-c.m. 16-ton B.L.R., 1 9-c.m. do., 2 M.	1 f. tu.	1886	70,000	13·00	50	—
c.b.	**Montcalm** (wood)	3621	230	3	46	1	5⅞	4¾	26	23	7	1	1830	6 19-c.m. B.L.R., 6 10-c.m., do., 8 M.	..	1868	..	11·65	—	—
b.	**Neptune** (4) (iron & steel)	10,581	330	0	65	7	18	16 barbettes	..	27	3	2	7000	2 34-c.m. 52-ton B.L.R., 2 27-c.m. 23-ton B.L.R., 20 14-c.m. 2½-ton do., 20 M.	4 f. tu. or l. car.	1887	600,000 including armament	15·00	600	3500 at 11
c.b. & b.	**Océan** . (wood)	7500	282	6	56	10	8	6¼	32	27	3	2	3781	4 27-c.m. 23-ton B.L.R., 4 24-c.m. 16-ton do., 4 12-c.m. 3-ton do., 8 M.	..	1868	..	13·70	650	—
c.s., t.	**Onondaga** (iron)	2600	228	4	51	2	5½	12¾	12	12	7	2	642	4 24-c.m. 16-ton B.L.R. .	..	1863	..	6·46	170	—
a.g. & b. b.	**Phlégéthon** (steel)	1640	181	10	40	4	8	8	..	11	10	2	1700	1 27-c.m. 28-ton B.L.R., 2 10-c.m. do., 2 M.	..	Bldg.	..	13·00	—	—
Armoured	**Protectrice** (*d*) .	1420	129	6	51	10	5½	4½	15¾	12	0	2	..	4 19-c.m. B.L.R., 1 l. . .	..	1866	..	6·0	—	—

c.b.	**Provence** (*d*)	(wood)	5819	262	5	55	10	6	4¼	26	27	2	2	3064	8 24-c.m. B.L.R., 3 19-c.m. do., 2 14-c.m. do., 3 12-c.m. do.	..	1863	..	13·70	—	—
c.b. & b.	**Redoutable**	(iron & steel)	9200	318	2	64	8	14	9½	15	25	6	2	6071	8 27-c.m. 24-ton B.L.R., 6 14-c.m. 3-ton. do., 8 M.	..	1876	..	14·66	510	2800
c.b.	**Reine Blanche**	(wood)	3900	230	3	46	2	6	4¾	26	23	8	1	1860	6 16-c.m. 8-ton B.L.R., 4 12-c.m. 3-ton do., 6 M.	..	1868	..	11·80	250	—
c.s., b.	**Requin** (²) .	(iron & steel)	7200	279	10	59	0	19½	17¾	..	24	7	2	6000	2 42-c.m. 75-ton B.L.R., 4 10-c.m. do., 4 M.	..	1885	..	14·00	500	—
c.b.	**Revanche**	(wood)	5819	262	5	55	10	6	4½	26	27	1	2	3187	8 24-c.m. 16-ton B.L.R., 3 19-c.m. 8-ton do., 2 14-c.m. 3-ton do., 3 12-c.m. do.	..	1865	..	13·25	500	—
c.b. & b. t	**Richelieu**	(wood)	9100	323	6	57	10	8½	6¼	..	27	11	2	4006	6 27-c.m. 23-ton B.L.R., 5 24-c.m. 16-ton do., 8 14-c.m. 3-ton do., 12 M.	..	1873	..	13·11	640	—
c.b.	**Savoie** .	(wood)	6000	262	5	55	10	6	4¼	26	28	0	1	3318	8 24-c.m. 16-ton B.L.R., 3 19-c.m. 4 14-c.m. do.	..	1864	..	13·47	—	—
a.g.b. & b.	**Styx** .	(steel)	1640	181	10	40	4	8	8	..	11	10	2	1700	1 27-c.m. 27-ton B.L.R., 2 10-c.m., 2 M.	..	Bldg.	..	13·00	—	—
c.b. & b.	**Suffren** .	(wood)	7600	282	6	57	10	8	6¼	32	29	10	1	4288	4 27-c.m. 23-ton B.L.R., 4 24-c.m. 9½-ton do., 6 14-c.m. 3-ton do., 12 M.	4 f. tu. or 1. car.	1870	..	14·30	700	—
c.s., b.	**Taureau** .	(wood)	2700	194	9	47	3	6	4¾	26	17	9	2	1800	1 24-c.m. 16-ton B.L.R. . .	..	1865	..	12·54	170	—
c.s., t.	**Tempête**	(iron & steel)	4523	248	0	57	9	13	12	15¾	16	9	1	1745	2 27-c.m. 28-ton B.L.R., 4 M. .	..	1876	..	10·20	120	—
c.s., b.	**Terrible** (²)	(iron & steel)	7200	279	10	59	0	19½	17¾	..	24	7	2	6000	2 42-c.m. 75-ton B.L.R., 4 10-c.m. do., 4 M.	..	1881	..	14·50	500	—
c.b.	**Thétis** .	(wood)	3621	230	3	46	2	6	4¾	26	20	10	1	1859	6 16-c.m. 8-ton B.L.R., 4 12-c.m. do., 6 M.	..	1877	..	12·00	250	—
c.s., t.	**Tigre** .	(wood)	3500	216	6	52	10	9	7	..	18	9	2	1880	2 24-c.m. 16-ton B.L.R. . .	..	1871	..	12·09	180	—
c.s., b.	**Tonnant**	(iron & steel)	4707	248	7	58	5	18	14½	15¾	17	3	1	1760	2 34-c.m. 48-ton B.L.R., 4 M. .	..	1880	..	11·00	120	—
c.s., t.	**Tonnerre**	(iron & steel)	5574	248	0	57	9	13	12	15¾	21	4	1	4165	2 27-c.m. 28-ton B.L.R., 4 10-c.m. 4 M.	..	1875	..	14·01	285	—
c.b. & b.	**Trident** .	(wood)	8800	317	9	56	4	8½	6¼	34	29	1	1	4652	8 27-c.m. 23-ton B.L.R., 2 24-c.m. 16-ton do., 4 14-c.m. 3-ton do., 4 M.	2 f. tu. or 1. car.	1876	..	14·17	540	—
”	**Triomphante**	(wood)	4700	258	2	48	9	6	4⅝	26	22	5	1	2200	6 24-c.m. 16-ton B.L.R., 1 19-c.m. 8-ton do., 6 14-c.m. 3-ton do.	..	1877	..	12·89	500	—

(*d*) According to a statement made by the Minister of Marine in 1886, the eight ships so marked are condemned as unfit for further service at sea.

FRANCE.—Armoured Ships—*continued.*

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length at Water Line.		Beam.*		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distar ce that can be steamed at 10 knots.
							Belt.	Battery or Turret.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
b.	**Turenne** . (wood)	6000	265	9	57	2	10	8	15	23	11	2	3955	4 24-c.m. 16-ton B.L.R., 2 19-c.m. 8-ton do., 6 14-c.m. 3-ton do., 12 M.	..	1879	..	14·14	400	—
c.b.	**Valeureuse**(*d*) (wood)	5774	262	5	56	4	6	4¼	..	27	6	1	3383	8 24-c.m. B.L.R., 1 19-c.m. 8-ton do., 6 16-c.m. do., 1 12-c.m. do.	..	1864	..	13·83	—	—
b.	**Vauban** . (steel)	5900	267	9	57	3	10	8	15	24	0	2	4060 (forced draught)	4 24-c.m. 16-ton B.L.R., 1 19-c.m. do., 6 14-c.m. 3-ton do., 12 M.	..	1882	..	14·32 forced draft.	400	—
c.s., t.	**Vengeur** (iron & steel)	4523	248	0	57	9	13	12	15¾	16	9	2	2319	2 27-c.m. 48-ton B.L.R., 4 M. .	..	1878	..	10·83	120	—
a.b. & b.	**Victorieuse** (wood)	4600	258	2	48	9	6	4¾	26	22	5	1	2214	6 24-c.m. 16-ton B.L.R., 1 19-c.m. 8-ton do., 6 14-c.m. 3-ton do.	..	1875	..	12·75	300	—

(*d*) According to a statement by the Minister of Marine in 1886, the eight ships so marked, are condemned as unfit for further service at sea.

NOTES ON THE FRENCH NAVY.—ARMOURED SHIPS.

(1) COURBET.

Courbet.

A casemate battleship, the Courbet, formerly called the Foudroyant, having unarmoured barbettes, one on each side of the upper deck, which was laid down at Toulon in 1876 and launched in 1882, was completed for sea during 1886. She is built of iron and steel, and was intended to be ship-rigged, with a large spread of canvas. She has, however, now a three-masted fore-and-aft rig, with military tops on each mast.

The principal dimensions are given in the list of armoured ships. The armament consists of four 34-c.m. B.L. guns in main deck casemate; four 27-c.m. B.L. on upper deck in barbettes, one forward, one aft, and one on each side amidships; six 14-c.m. B.L. in the broadside on upper deck; twelve machine guns, and four above-water torpedo dischargers. The armour is iron, and consists of a belt 15 in. to 8¾ in. thick, and extending from 4 ft. above the water-line to 5½ ft. below it, and the belt is complete to near the stern. The conning tower, and a complete protective deck on top of the belt, is formed of 1½-in. steel on 2-in. iron plates. The coal carried is 628 tons, and the complement of men and officers 680.

At the steam trials in 1886, the horse-power developed was 6016 with natural draught, and 8100 with forced draught, when the speed was 14·2 knots.

(2) INDOMPTABLE.

Indomptable.

The Indomptable, sister ship to the Caiman, Requin, and Terrible, described on page 230 of *The Naval Annual* for 1886, laid down at L'Orient in 1877, and launched in September, 1883, was completed for sea during 1886, and she had her final steam trials off Brest in August, 1886. The speed realised was 15 knots, and at that speed the bow wave was very great. The amount of coal carried is stated to be 800 tons. She has two military masts, and the complement of officers and men is 300.

(3) TERRIBLE.

Terrible.

Another ship of the Caiman class—the Terrible—was completed for sea in the spring of 1887, she, like the others of the class, having been laid down in 1877.

([4]) NEPTUNE.

Neptune. The Neptune, sister ship to the Marçeau, Magenta, and Hoche, was launched at Brest Dockyard on 7th May, 1887. This vessel is protected with compound armour, and is fitted with barbette towers and twin screws.

The hull is built on the cellular system, having a double bottom. The outer bottom is constructed of iron up to the armour shelf. The upper works are of steel plates. Iron has been preferred to steel below the water. For the upper works the use of steel secures a considerable economy of weight. The armour belt has a thickness of 12 inches at the lower edge, and 18 inches at the upper edge. The armoured deck has a thickness of 3 inches. The ship is subdivided internally by 13 transverse bulkheads. The hull is further subdivided into 17 lateral compartments, more or less further subdivided by the transverse and horizontal bulkheads of the internal fittings. By these arrangements it is claimed that the utmost quantity of water which could be admitted by any single explosion of a torpedo is limited to 250 tons.

The water-line belt is fixed to a teak backing, which again rests upon a double inside skin.

The barbettes, four in number, will be protected with 16-in. plates. Two of these are amidships, and at the sides of the ship another is forward, and the fourth abaft. Each barbette will rest upon a platform, supported by an armoured tube, which transmits the pressure of the superincumbent weight to the main deck, and communicates with the magazines by an armoured shaft.

The armament of the Neptune consists of two 52-ton guns, mounted in the bow and stern barbettes, and of two 23-ton guns mounted on the barbettes amidships. Two 2½-ton guns will be mounted on the upper deck, and 18 guns of the same calibre in the battery. The armament includes 20 Hotchkiss guns and 4 torpedo launching tubes, two amidships and two astern. The barbettes will be covered with a steel shield, two inches in thickness, as a protection to the gun's crew from the fire of machine guns and musketry.

The ship is rigged with three lower masts with light top-masts, but will carry fore-and-aft canvas only.

The cost of the hull of vessels of this type, including material and labour, is given in the French Budget at £380,000; the machinery will cost £120,000. To these figures should be added the cost of the armament, which cannot be estimated at less than £80,000; thus the ship, when fit for sea, will have cost £600,000.

(^{5}) HOCHE AND MARÇEAU.

Hoche and Marçeau.

The first-class ironclad Hoche was launched at Lorient on 29th September, 1886, and a sister vessel, the Marçeau, at La Seyne-sur-Mer, near Toulon, on 24th May, 1887. The weight of the hull of these vessels is 3875 tons, and the plates on the ironclad deck are 4 in. thick, and they extend the full length of the vessel. The engines, boilers, powder magazines, and the apparatus to be used for manœuvring the heavy artillery, will be well protected, the weight of the plates on the sides of the vessel, the deck, and the turrets exceeding 3000 tons. The weight of the engines is about 626 tons, and that of the boilers about 341 tons. The expected speed is 15 knots an hour. They are to be armed with four 14-in. 52-ton guns, placed in four barbette turrets, two of which are placed in the longitudinal axis of the vessel, one forward and another astern, with two others on the sides. The small artillery will include seventeen 6-in. guns in the battery, while revolving and rapid-firing guns will be placed in various parts of the vessel. There will also be four torpedo tubes.

(^{6}) DUGUESCLIN.

Duguesclin.

The Duguesclin, an armoured twin-screw cruiser, which was laid down at Rochefort in 1876, launched in April, 1883, had her final steam trials in August, 1886. She is built of iron and steel and sheathed with wood and coppered. She is brig-rigged, and has a large spread of canvas. Her complement of officers and men is 450. Coal stowage, 400 tons. The dimensions are given in the tables. She has four 9½-in. B.L. guns, in four barbette towers; one 7½-in. B.L. in the bow, and six 5½-in. B.L. in the broadside; two 6-pdr. Q.F. guns, and twelve machine guns; two torpedo above-water dischargers. She has a complete belt of armour 9 in. to 6½ in. thick. The barbettes are forward, one abaft and one on each side amidships are covered with 8-in. compound armour. The conning tower on fore bridge is of 2-in. plates. The deck on top of the belt is covered with 2-in. plates.

The engines are three-cylinder, and there are eight cylindrical two-furnace boilers. The horse-power is 4100, and the speed 14 knots.

(^{7}) COCYTE.

Cocyte.

An armoured coast-defence twin-screw gunvessel—the Cocyte—which was laid down at Cherbourg in 1882, was launched on

Cocyte.

13th January, 1887. She is a sister vessel to the Acheron. The indicated horse-power is 1700, and the expected speed 13 knots.

(8) MITRAILLE.

Mitraille.

On 3rd July, 1886, there was launched from Rochefort Dockyard an armoured twin-screw gunboat of the Fusée class (described at page 230 in *The Naval Annual* for 1886). She will be completed in 1887, and will cost about £70,000. This vessel and her sisters, Fusée, Flamme and Grénade, are sheathed with wood and coppered.

(9) BRENNUS AND CHARLES MARTEL.

Brennus and Charles Martel.

The construction of these two ironclads has for some time been discontinued. In the French Navy estimates for 1888 provision is made for the commencement of a new armoured ship to be called the Brennus.

From statements made in the French Chamber, it appears that the following ships have been condemned as unfit for further service, viz., Alma, Atalante, Belliqueuse, Flandre, Imprenable, Protectrice, Provence, Valeureuse. The Protectrice has been used as a target for torpedoes, and a hole has been blown in her side.

FRANCE.—Unarmoured Ships.

The divisions of the French unarmoured ships follow the official classification. The designation of each class is made, wherever practicable, to correspond with the usual parallel English equivalent. The French system of nomenclature is based on two distinct principles—that of the design of a ship, and that of the service for which a ship is intended. *Eclaireurs d'Escadre* are classed as sloops, that being the nearest English equivalent. *Avisos* are classed as despatch vessels to distinguish them from the *Canonnières de Station*, classed as gun-vessels, which they resemble more closely than they do the British Helicon. The *Canonnières de Station* differ little from British gun-*boats* of the Espoir class; they have been classed as gun-*vessels* to distinguish them from the several kinds of French gun-boats.

cr., cruiser; *d.v.*, despatch vessel; *fr.c.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; *s.g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.g.v.*, torpedo gun-vessel; P. deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Dischargers for Torpedoes.					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
fr.c.	**Alger P (3)**	4160	354	0	42	6	steel	19	0	2	..	4 16-c.m. 5-ton B.L.R., 6 14-c.m. 3-ton do., 4 Q.F., 6 M.	4 f. tu. or l.car	Bldg.	..	19·00	—	—
fr.c.	**Aréthuse**	3400	277	6	43	6	wood	21	9	1	4200	4 16-c.m. 5-ton B.L.R., 23 14-c.m. 3-ton. do., 8 M.	..	1882	..	14·00	—	—
g.v.	**Aspic**	480	145	4	23	10	composite	10	6	1	453	2 14-c.m. B.L.R., 2 10-cm. do.	..	1880	..	10·30	—	—
s.g.to.	**Balny**	70	131	0	10	10	steel	4	5	..	..	2 M.	..	1886	..	22·00	—	—
sl.	**Beautemps-Beaupré**	1350	204	8	34	2	wood	15	10	1	985	5 14-c.m. 3-ton B.L.R., 4 M.	..	1872	..	12·60	—	—
d.v.	**Bisson**	880	199	5	28	5	wood	12	8	1	849	3 14-c.m. 3-ton B.L.R., 1 10-c.m. do., 5 M.	..	1874	..	11·78	—	—
to.g.v.	**Bombe**	320	196	10	21	7	steel	5	11	2	1800	2 4-in. B.L.R., 3 M.	2 f. tu. or l.car	1885	..	18·00	—	—
s.g.to.	**Bouet Willaumez**	70	131	0	10	10	steel	4	5	..	700	2 M.	..	1886	..	22·00	—	—
sl.	**Bougainville**	800	182	0	31	9	wood	12	9	1	449	6 12-c.m. B.L.R.	..	1859	..	9·34	—	—
d.v.	**Bourayne**	1290	204	8	34	4	wood	15	10	1	768	1 16-c.m. 5-ton B.L.R., 6 14-c.m. do., 2 M.	..	1869	..	11·20	—	—
d.v.	**Boursaint**	780	198	4	28	0	wood	12	8	1	679	1 16-c.m. 5-ton B.L.R., 2 14-c.m. 3-ton do.	..	1872	..	11·51	—	—
„	**Bouvet**	870	197	6	28	0	wood	12	2	1	817	3 14-c.m. 3-ton B.L.R., 1 10-c.m. do., 3 M.	..	1876	..	11·39	—	—
s.g.to.	**Capitaine Cuny**	70	131	0	10	10	steel	4	5	..	700	2 M.	..	1885	..	22·00	—	—
„	**Capitaine Mehl**	70	131	0	10	10	steel	4	5	..	700	2 M.	..	1886	..	22·00	—	—

FRANCE.—Unarmoured Ships—*continued.*

cr., cruiser; *d.v.*, despatch vessel; *fr.c.*, frigate-built cruiser; *g.v.*, gun vessel; *sl.*, sloop; *s.g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.g.v.*, torpedo gun-vessel; P, deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.		Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Dischargers for Fish Torpedoes.	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
			tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
g.v.	**Capricorne**		480	148 4	23 10	wood	10 5	1	443	2 14-c.m. 3-ton B.L.R., 2 10-c.m. do.	..	1882	..	11·18	—	—
fr.c.	**Cecille** (5)	P.	5766	378 9	49 3	iron and steel	19 9	2	9600 (forced draught)	6 16-c.m. 5 ton B.L.R., 10 14-c.m. 3-ton do., 3 Q.F., 10 M.	4 f. tu. or l.car	Building.	hull, 181,666; engines, 116,000.	19·00	—	—
g.v.	**Chacal**		460	142 6	24 4	wood	9 5	2	251	1 14-c.m. 3-ton B.L.R., 1 12-c.m., 2 M.	..	1868	..	9·13	—	—
cr.	**Champlain**		2000	258 10	35 8	wood	16 0	1	1953	1 16-c.m. 5-ton B.L.R., 9 14-c.m. 3-ton do.	..	1872	..	14·29	—	—
s.g.to.	**Challier**		70	131 0	10 10	steel	4 5	..	700	2 M.	..	1886	..	22·00	—	—
cr.	**Chanzy** (6)	P.	3027	297 6	40 0	steel	17 6	2	9000	4 16-c.m. B.L.R., 4 Q.F., 6 M.	4 f. tu. or l.car	Bldg.	..	20·00	480	4000 at 12½ kts
d.v.	**Chasseur**		930	199 5	28 5	wood & iron	12 7	1	850	4 14-c.m. 3-ton B.L.R.	..	1878	..	11·06	—	—
cr.	**Château Renault**		1875	262 2	35 3	wood	18 2	1	1701	7 14-c.m. 3-ton B.L.R.	..	1868	..	14·27	—	—
„	**Clorinde**		1800	..	..	..	..	..	..	16 14-c.m. 3-ton B.L.R.	—	—	—	10·00	—	—
g.v.	**Comete**		495	151 6	24 9	composite	10 6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	..	—	—
to.cr.	**Condor** (6)		1280	216 6	29 3	steel	15 5	2	3800	5 10-c.m. B.L.R., 6 M.	5 f. tu. or l.car	1885	80,000	17·70	—	—
cr.	**Coetlogon** (7)	P.	1850	312 0	30 5	steel	14 0	2	6000	2 14-c.m. B.L.R, 3 Q.F., 4 M.	5 f. tu. or l.car	Bldg.	..	19·50	200	2400
d.v.	**Corse**		520	148 7	27 11	wood	11 10	1	276	1 19-c.m. B.L.R., 2 10-c.m. do.	..	1842	..	10·15	—	—
cr.	**Cosmao** (7)	P.	1850	312 0	30 5	steel	14 0	2	6000	2 14-c.m. 3-ton B.L.R., 3 Q.F., 4 M.	5 f. tu. or l.car	Bldg.	..	19·50	200	2400
g.v.	**Crocodile**		450	141 10	24 0	composite	9 5	1	441	2 14-c.m. B.L.R.	..	1874	..	9·68	—	—
to.g.v.	**Couleuvrine**		320	196 10	21 7	steel	5 11	2	1800	2 4-inch B.L.R., 3 M.	2 f. tu. or l.car	1885	..	18·00	—	—
„	**Dague**		320	196 10	21 7	steel	5 11	2	1800	2 4-inch B.L.R., 3 M.	2 f. tu. or l.car	Bldg.	..	18·00	—	—

cr.	**Davoust** (²)	P	3027	297	6	40	0	steel	17	6	2	9000	4 16-c.m. B.L.R., 4 Q.F., 6 M.	4 f. tu. or l.car	Bldg.	..	20·00	480	4000 at 12½ kts.
sl.	**Dayot**		1350	204	8	34	4	wood	15	10	1	917	1 16-c.m. 5-ton B.L.R., 5 14-c.m. do., 2 M.	..	1869	..	11·76	—	—
cr.	**Decrès**		1800	244	3	38	8	wood	18	2	1	1478	1 16-c.m. 5-ton B.L.R., 9 14-c.m. 3-ton do.	..	1866	..	12·04	—	—
s.g.to.	**Dehorter**		70	131	0	10	10	steel	4	5	..	700	2 M.	..	1886	..	22·00	—	—
”	**Déroulède**		70	131	0	10	10	steel	4	5	..	700	2 M.	..	..	..	22·00	—	—
cr.	**Desaix**		1700	259	2	34	8	wood	17	7	1	1442	4 10-c.m. B.L.R., 2 M.	..	1866	..	14·21	—	—
”	**D'Estaing**		2400	262	5	37	5	wood & iron	18	8	1	3700	15 14-c.m. 3-ton B.L.R., 10 M.	..	1879	..	15·31	—	—
sl.	**D'Estrées**		1340	207	4	34	0	wood	15	9	1	1003	1 16-c.m. 5-ton B.L.R., 5 14-c.m. 3-ton do., 2 M.	..	1867	..	12·30	—	—
s.g.to.	**Doudart de Lagrée**		70	131	0	10	10	steel	4	5	..	700	2 M.	..	1886	..	22·00	—	—
to.g.v.	**Dragonne**		320	196	10	21	7	steel	5	11	2	1800	2 4-inch B.L.R., 3 M.	2 f. tu. or l.car	..	..	18·00	—	—
fr.c.	**Dubourdieu**		3400	253	7	46	6	wood	22	10	1	3300	4 16-c.m. 5-ton B.L.R. 22 14-c.m. 3-ton B.L.R.	1 f. tu. or l.car	1884	hull, 95,833; machinery, 30,720; equipment, 28,000.	14·00	—	—
sl.	**Duchaffaud**		1340	204	8	34	2	wood	16	0	1	1214	6 14-c.m. 3-ton B.L.R., 2 M.	..	1872	..	12·72	—	—
”	**Ducouedic**		1340	204	8	34	2	wood	16	6	1	769	1 16-c.m. 5-ton B.L.R., 5 14-c.m. 3-ton do., 2 M.	..	1869	..	11·57	—	—
cr.	**Duguay Trouin**		3300	296	3	43	4	iron & wood	20	6	1	3740	5 19-c.m. 8-ton B.L.R., 5 14-c.m. 3-ton. do.	..	1877	..	15·90	430	—
g.v.	**Dumont d'Urville**		860	201	11	28	6	wood	13	8	1	850	4 14 c.m. 3-ton B.L.R.	..	1878	..	11·60	—	—
cr.	**Du Petit Thouars**		2000	257	10	35	9	wood	16	0	1	2018	10 14-c.m. 3-ton B.L.R.	..	1874	..	15·07	—	—
”	**Dupleix**		1850	210	0	37	5	wood	18	0	1	1215	12 14-c.m. 3-ton B.L.R.	..	1861	..	11·47	—	—
fr.c.	**Dupuy de Lôme** (³)	P	4160	354	0	42	6	steel	19	0	2	..	4 16-c.m. 5-ton B.L.R., 6 14-c.m. 3-ton do., 4 Q.F., 6 M.	4 f. tu. or l.car	Bldg.	..	19·00	—	—
”	**Duquesne**		5800	333	5	50	3	iron & wood	25		1	6589	7 13-c.m. 8-ton B.L.R., 14 14-c.m. 3-ton do., 8 M.	..	1876	..	16·90	600	—
sl.	**Éclaireur**		1830	236	3	35	5	iron & wood	17	0	1	2050	8 14-c.m. 3-ton B.L.R., 2 M.	..	1877	..	15·00	—	—
s.g.to.	**Edmond Fontaine**		70	131	0	10	10	steel	4	5	..	700	2 M.	..	1886	..	22·00	—	—
g.v.	**Etendard**		510	142	6	24	4	wood	9	5	2	232	1 19-c.m. B.L.R., 1 12-c.m. do.	..	1868	..	7·00	—	—

FRANCE.—Unarmoured Ships—*continued.*

cr., cruiser; *d.v.*, despatch vessel; *fr.c.*, frigate-built cruiser; *g.v.*, gun vessel; *sl.*, sloop; *s.g.to.*, sea-going torpedo-boat; *to.cr.*, torpedo cruiser; *to.g.v.*, torpedo gun-vessel; P, deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
to.cr.	**Epervier** (*)	1280	216	6	29	3	steel	15	5	2	3200 (forced draught)	5 10-c.m. B.L.R., 6 M. . . .	5 f. tu. or l.car	1885	80,000	17·00	—	—
g.v.	**Étoile**	450	149	3	24	7	composite	8	4	2	450	2 14-c.m. 3-ton B.L.R., 2 10-c.m. do., 2 M.	..	1885	..	10·00	—	—
cr.	**Fabert**	2100	249	4	36	0	wood	18	4	1	1107	8 14-c.m. 5-ton B.L.R. . . .	..	1874	..	12·42	—	—
g.v.	**Fanfare**	510	142	0	24	4	wood	9	5	2	233	1 19-c.m. B.L.R., 1 12-c.m. do. .	..	1868	..	8·39	—	—
to.cr.	**Faucon** (*)	1280	216	6	29	3	steel	15	5	2	3200 (forced draught)	5 10-c.m. B.L.R., 6 M. . .	5 f. tu. or l.car	1885	80,000	17·00	—	—
to.g.v.	**Fleche**	320	196	10	21	7	steel	5	11	2	1800	2 4-inch B.L.R., 3 M. . . .	2 f. tu. or l.car	..	..	18·00	—	—
cr.	**Forbin** (') . . . P.	1850	312	0	30	5	steel	16	0	2	6000	2 14-c.m. 3-ton B.L.R., 3 Q.F., 4 M.	5 f. tu. or l.car	Bldg.	..	19·50	200	2400
cr.	**Forfait**	2400	249	4	38	0	wood & iron	18	0	1	2764	15 14-c.m. 3-ton B.L.R., 2 l., 6 M. .	..	1879	..	13·44	—	—
g.v.	**Fulton** (*)	825	199	5	28	5	wood	12	8	1	850	4 14-c.m. 3-ton B.L.R. . . .	..	1887	37,000	13·00	—	—
„	**Gabes**	490	151	6	24	9	„	10	6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	11·00	—	—
„	**Gabriel Charmes** . .	474	142	0	24	5	composite	9	5	1	443	1 14-c.m. 3 ton B.L.R. . . .	..	1885	..	11·00	—	—
„	**Gladiateur** . . .	400	142	0	24	4	wood	9	5	2	218	1 14-c.m. B.L.R., 1 12-c.m. do., 2 M.	..	1868	..	8·30	—	—

d.v.	**Guichen**		750	183	6	28	0	„	12	0	1	593	1 16-c.m. 5-ton B.L.R., 1 14-c.m. 8-ton do.	..	1865	..	10·70	—	—
sl.	**Hamelin**		1840	207	7	34	2	„	15	10	1	1155	1 16-c.m. B.L.R., 5 14-c.m. B.L.R., 2 M.	..	1866	..	12·58	—	—
d.v.	**Hirondelle**		1040	249	6	30	4	wood	12	8	2	1780	2 14-c.m. 3-ton B.L.R.	..	1869	..	15·50	—	—
sl.	**Hugon**		1340	204	5	34	2	„	15	10	1	1054	1 16-c.m. 5-ton B.L.R., 5 14-c.m. 3-ton do., 2 M.	..	1872	..	11·72	—	—
d.v.	**Hussard**		880	201	10	28	6	„	13	7	1	850	4 14-c.m. 3-ton B.L.R.	..	1877	..	12·08	—	—
g.v.	**Hyène**		470	142	0	24	5	„	9	5	2	258	1 14-c.m. B.L.R., 1 10-c.m. do.	..	1868	..	9·06	—	—
d.v.	**Inconstant** (5)		825	199	5	28	5	„	12	7	1	850	4 14-c.m. 3-ton B.L.R.	..	1886	37,000	13·00	—	—
cr.	**Infernet**		1931	262	2	35	9	„	18	4	1	1815	1 16-c.m. 5-ton B.L.R., 7 14-c.m. 3-ton do.	..	1869	..	13·90	—	—
fr.c.	**Iphigénie**		3200	244	6	46	6	„	22	4	1	2800	2 16-c.m. 5-ton B.L.R., 18 14-c.m. 3-ton do., 10 M., 3 l.	..	1881	..	14·60	—	—
cr.	**Isly** (3)	P	4160	354	0	42	6	steel	19	2	2	..	4 16-c.m. 5-ton B.L.R., 6 14-c.m. 3-ton do., 4 Q.F., 6 M.	4 f. tu. or l.car	Bldg.	..	19·00	—	—
g.v.	**Jaguar**		460	142	0	24	5	wood	9	5	2	270	1 14-c.m. B.L.R., 1 12-c.m. do., 2 M.	..	1868	..	9·37	—	—
Torpedo Depot Ship.	**Japon**		3970	..		..		..	..		1	1500	2 guns	—	—	—	—	—	—
fr.c.	**Jean Bart**	P	4160	354	0	42	6	steel	19	2	2	..	4 16 c.m. 5-ton B.L.R., 6 14-c.m. 3-ton do.	..	Bldg.	..	19·00	—	—
sl.	**Kerguelen**		1340	204	5	34	2	wood	15	10	1	1200	6 14-c.m. 3-ton B.L.R., 2 M.	..	1872	..	12·76	—	—
d.v.	**Labourdonnais**		860	199	5	28	5	„	12	7	1	787	4 14-c.m. 3-ton B.L.R.	..	1875	..	11·69	—	—
cr.	**Laclocheterie**		2000	262	2	35	9	„	18	4	1	1918	10 14-c.m. 3-ton B.L.R., 2 l.	..	1872	..	13·73	300	—
„	**Lalande** (7)	P.	1877	311	6	31	2	steel	14	0	2	6000	2 14 c.m. B.L.R., 3 Q.F., 4 M.	5 f. tu. or l.car	Bldg.	..	19.50	—	—
to.g.v.	**Lance**		320	196	10	21	7	„	5	11	2	1800	2 4-inch B.L.R., 3 M.	2 f. tu. or l.car	1886	..	18·00	—	—
cr.	**Lapérouse**		2100	262	5	37	5	wood & iron	18	8	1	2280	15 14-c.m. 3-ton B.L.R., 6 M., 2 l.	..	1877	..	14·73	—	—
sl.	**Limier**		1330	207	4	34	0	„	15	10	1	1084	6 14-c.m. 3-ton B.L.R., 2 M.	..	1866	..	11·80	—	—
„	**Linois**		1210	203	5	32	2	„	15	2	1	720	6 14-c.m. 3-ton B.L.R., 2 M.	..	1867	..	11·50	—	—
g.v.	**Lion**		470	151	6	24	9	composite	10	6	1	400	2 14-c.m. 3-ton B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	11·00	—	—
„	**Lionne**		500	141	9	23	11	„	9	6	1	426	1 14-c.m. B.L.R., 2 M., 2 l.	..	1877	..	9·81	—	—
„	**Lutin**		490	141	9	23	11	„	9	4	1	427	2 14-c.m. B.L.R., 2 l.	..	1877	..	10·00	—	—
„	**Lynx**		485	141	9	23	11	„	9	4	1	427	2 14-c.m. B.L.R., 2 l.	..	1878	..	10·38	—	—

FRANCE.—Unarmoured Ships—*continued*.

cr., cruiser; *d.v.*, despatch vessel; *fr.c.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; *s.g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.g.v.*, torpedo gun-vessel; P, deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
									Guns.	Dischargers for Torpedoes.					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
cr.	**Magon**	2300	249 4	38 0	wood & iron	18 0	1	2462	15 14-c.m. 3-ton B.L.R., 6 M., 2 l.	..	1880	..	14·17	-	—
g.v.	**Météore**	470	151 6	24 9	composite	10 6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	1884	..	10·00	—	—
sl.	**Milan**	1540	303 2	32 10	steel	14 7	2	4132	5 10-c.m. B.L.R., 8 M.	2 f. tu. or l.car	1884	..	18·00	—	—
fr.c.	**Minerve**	2800	246 9	42 8	wood	21 4	1	1601	14 14-c.m. 3-ton B.L.R., 5 M.	..	1865	..	10·91	—	—
cr.	**Mogador** (4) P.	4325	351 0	44 0	steel	20 0	2	8200	4 16-c.m. B.L.R., 6 14-c.m. do., 4 Q.F., 6 M.	f. tu. or l.car	Bldg.	..	19·00	—	—
fr.c.	**Naiade**	3600	246 0	47 2	wood & iron	22 10	1	3260	4 16-c.m. 5-ton B.L.R., 18 14-c.m. 3-ton do., 4 M.	4 f. tu. or l.car	1881	..	13·68	—	—
cr.	**Nielly**	2300	262 5	37 5	„	18 8	1	2921	15 14-c.m. 3-ton B.L.R., 10 M.	..	1880	..	15·23	—	—
s.g.to.	**Ouragan**	148	157 0	16 8	steel	8 5	1	..	2 M.	..	Bldg.	..	25·00	—	—
d.v.	**Papin** (7)	825	199 6	28 6	wood	13 7	1	850	4 14-c.m. 3-ton B.L.R.	..	1886	37,000	13·00	—	—
d.v.	**Parseval**	790	197 6	28 0	„	12 2	1	817	4 14-c.m. 3-ton B.L.R.	..	1879	..	12·33	—	—
cr.	**Primauguet**	2400	262 5	37 5	wood & iron	18 8	1	2268	15 14-c.m. 3-ton B.L.R., 10 M.	..	1882	..	14·50	—	—
sl.	**Rigault de Genouilly**	1710	236 3	35 5	wood and iron topsides	17 0	1	2050	8 14-c.m. 3-ton B.L.R., 2 M.	..	1876	..	14·49	—	—
cr.	**Roland**	2300	249 4	38 0	„	17 7	1	2700	15 14-c.m. 3-ton B.L.R., 6 M.	..	1882	..	14·50	—	—
g.v.	**Sagittaire**	490	148 4	23 10	„	10 5	1	427	2 14-c.m. B.L.R., 2 10-c.m. do.	..	1881	..	11·05	—	—
to.g.v.	**Sainte Barbe**	320	196 10	21 7	steel	5 11	2	1800	2 4-inch B.L.R., 3 M.	2 f. tu. or l.car	1885	..	18·00	—	—
„	**Salve**	320	196 10	21 7	„	5 11	2	1800	2 4-inch B.L.R., 3 M.	2 f. tu. or l.car	1886	..	18·00	—	—

cr.	**Sané**		1900	255	0	36	0	wood	18	4	1	1998	6 14-c.m. 3-ton B.L.R.	..	1870	..	15·02	—	—
g.v.	**Scorpion**		470	151	6	24	9	composite	10	6	1	450	2 14-c.m. 3-ton B.L.R., 2 10-c.m. do.	..	1883	..	11·00	—	—
sl.	**Segond**		1280	204	8	34	2	wood	15	10	1	894	6 14-c.m. 3-ton B.L.R., 2 M.	..	1869	..	11·26	—	—
cr.	**Seignelay**		1900	255	0	36	0	„	18	4	1	1967	8 14-c.m. 3-ton B.L.R.	..	1874	..	15·00	—	—
fr.c.	**Sfax** (5)	P.	4488	288	9	49	3	steel & wood	24	9	2	6034	6 16-c.m. 5-ton B.L.R., 10 14-c.m. 3-ton do., 3 Q.F., 5 M.	..	1884	200,000	16·84	800	—
g.v.	**Sirius**		473	142	0	24	9	wood	10	6	1	450	2 14-c.m. B.L.R., 2 10-c.m. do., 2 M.	..	Bldg.	—	—	—	—
cr.	**Suchet** (6)	P.	3027	297	6	40	0	steel	17	6	2	9000	4 16-c.m. B.L.R., 4 Q.F., 6 M.	4 f. tu. or l.car	Bldg.	..	20·00	480	4000 at 12½ kts.
„	**Surcouf** (7)	P.	1850	312	0	30	5	„	14	0	2	6000	2 14-c.m. 3-ton B.L.R., 3 Q.F., 4 M.	5 f. tu. or l.car	Bldg.	..	19·50	200	2400
to.cr.	**Tage** (1)	P.	7045	390	0	53	8	„	22	10	2	10,330	6 16-c.m. B.L.R., 10 14-c.m. do., 3 Q.F., 12 M.	7 f. tu. or l.car	1886	..	19·00	800	—
sl.	**Talisman**		1410	224	9	33	6	wood	15	5	1	691	4 14-c.m. 3-ton B.L.R., 2 10-c.m. do., 2 M.	..	1862	..	11·28	—	—
fr.c.	**Tourville**		5600	333	5	50	3	iron & wood	25	4	1	7466	7 19-c.m. 5-ton B.L.R., 14 14-c.m. 3-ton do.	..	1876	..	16·89	800	—
cr.	**Tronde** (7)	P.	1877	311	6	31	2	steel	14	0	2	6000	2 14 c.m. 3-ton B.L.R., 7 M.	5 f. tu. or l.car	Bldg.	..	19·50	—	—
sl.	**Vaudreuil**		1280	204	8	34	1	wood	15	10	1	867	6 14-c.m. 3-ton B.L.R., 2 M.	..	1870	..	11·00	—	—
to.cr.	**Vautour** (8)		1280	216	6	29	3	steel	15	5	2	3200	5 10-c.m. B.L.R., 6 M.	5 f. tu. or l.car	1886	80,000	17·00	—	—
fr.c.	**Vénus**		2800	246	9	42	8	wood	21	4	1	1308	16 14-c.m. B.L.R., 6 M.	..	1864	..	12·57	—	—
cr.	**Villars**		2400	249	4	38	0	wood & iron	17	7	1	2380	15 14-c.m. 3-ton B.L.R., 6 M.	..	1879	..	14·25	—	—
g.v.	**Vipère**		490	145	4	23	10	composite	10	6	1	427	2 14-c.m. B.L.R., 2 10-c.m. do.	..	1881	..	10·30	—	—
d.v.	**Volage**		510	160	5	28	3	wood	11	9	1	401	2 9-c.m. B.L.R., 4 M.	..	1881	..	10·76	—	—
sl.	**Volta**		1350	207	8	33	9	„	15	7	1	1066	6 14-c.m. 3-ton B.L.R., 2 M.	..	1867	..	12·94	—	—
d.v.	**Voltigeur**		910	199	5	28	5	wood & iron	12	7	1	850	4 14-c.m. 3-ton B.L.R.	..	1878	..	12·48	—	—

Besides transports, of which there is a large number, store ships, surveying vessels, training ships, yachts, sailing vessels, &c., there are, on the List of the French Navy, the following:—

River and local (screw) despatch vessels (Avisos de flotille).—Actif, Carpe, Chimère, Cuvier, Élan, Ibis, Loyalty, Marabout, Mirmidon, Mouette, Pygmée, Rubis, Turquoise. 165 to 254 tons; 205 to 417 I.H.P.

River and local (paddle) despatch vessels (Avisos de flotille).—Albatros, Alcyon, Alouette, Ardent, Basilic, Bengali, Brandon, Cigale, Cigogne, Écureuil, Goëland, Gogah, Héron, Jouffroy, Laprade, Lézard, Magicien, Mesange, Nagotna, Oyap-ock, Pétrel, Pingouin, Pluvier, Salamandre, Souffleur, Travailleur, Vigilant.

River (screw) gunboats (Chaloupes canonnières).—Alerte, Arquebuse, Avalanche, Bäionette, Bouclier, Bourrasque, Carabine, Caronade Casse-tête Cimeterre, Épée, Escopette, Estoc, Flamberge, Framée, Glaive, Hache, Harpon, Javeline, Javelot, Massue, Mitrailleuse, Mousqueton, Mutine, Oluma (building for the Congo), Perrier, Rafale, Raynaud, Redoute, Revolver, Rollandes, Tirailleuse, Tromblon.

River (paddle) gunboats (Chaloupes canonnières).—Berthe-de-Villars, Biche, Bouillot, Bossant, Chamois, Cuvellier, Éclair, Garnier, Henry-Rivière, Jacquin, Moulun, Pionnier, Trombe.

In addition to the sea-going torpedo-boats in the Tables, there are—9 first class torpedo-boats of 133 feet in length building and completed; 51 of 115 feet in length, and about 53 tons displacement, building and completed; and 18 of about 108 feet in length and about 50 tons displacement, completed. About 30 torpedo-boats will shortly be ordered of private firms; but the Government is waiting the trials of existing boats before giving out the orders. Boats of the second class under 100 feet in length, and displacement from 36 to 27 tons, 42 completed; and under 70 feet in length, 34 completed and 6 building.

NOTES ON THE FRENCH NAVY.— UNARMOURED SHIPS.

(1) TAGE.

The Tage.

The Tage, a first-class protected cruiser, having twin screws, now being built for the French Government by contract on the Loire, was launched on 28th October, 1886, and will, it is expected, be complete for sea in 1888.

Her dimensions are as follows:—Length, 390 ft.; breadth, 53 ft. 8 in.; mean draught of water, 22 ft. 10 in.; displacement, 7045 tons.

The hull generally is built of steel, but the stern, stern posts, keel, and protective deck plates are of iron. Protection is given to the engines, boilers, magazines, &c., by an armoured deck situated below the water and extending throughout the ship, and also by numerous water-tight bulkheads, which divide the space above into a large number of separate compartments. There will also be a belt of cellulose, which will add materially to the floating power of the ship when damaged by shot or shell, and the hatchways and steering gear will also be protected by armour.

The engines will be three-cylinder, of the horizontal type. The horse-power with natural draught will be 8115, and with forced draught 10,330.

The armament will consist of six 16-c.m. B.L. guns on the upper deck, ten 14-c.m. in the battery, three Q.F. guns of 47 mm., and twelve Hotchkiss 37-mm. machine-guns. She will also have seven Whitehead dischargers placed above the water line.

The speed of the Tage is expected to be 19 knots. She will have three masts and a spread of sails. It is expected that the speed of this ship will be a knot faster than the English cruisers now building.

(2) CECILLE.

The Cecille.

For a description of the Cecille see page 238 of *The Naval Annual* for 1886. She is nearly of the same type as the Tage, but smaller. She is still on the stocks.

(3) DUPUY-DE-LÔME CLASS.

The Dupuy-de-Lôme class.

The French Government in October, 1886, ordered two ships of this class—the Dupuy-de-Lôme and the Jean Bart—to be laid down in Brest and Rochefort dockyards respectively.

Their dimensions are:—Length, 354 ft.; breadth, 42½ ft.; mean draught of water, 19 ft.; and their displacement, 4160 tons. The speed is to be 19 knots. They have a complete steel protective deck. Their armament is to be four 16-c.m. 5-ton B.L.R. guns on sponsons, six 14-c.m. 3-ton guns of the same description on the broadside, four 3-pdr. Q.F. guns, six machine-guns, and four Whitehead torpedo dischargers.

Alger, Isly.

The French Chamber having in March, 1887, voted a supplementary grant of one million pounds sterling for shipbuilding, it has been decided to lay down at once the following:—at Cherbourg one ship of this class, to be called the Alger; at Brest another of the class, to be called the Isly.

The *Journal de la Marine* states that the Dupuy-de-Lôme, which was to have been built at Cherbourg after the plans of M. Thibeaudier, is now to be built at Brest on the plans of Inspector-General de Bussy. It is stated that she is to be protected from one end to the other against the effects of projectiles charged with powerful explosives. The following are to be her dimensions:—length, 374 ft. breadth, 52 ft.; mean draught of water, 23 ft. 3 ins.; displacement, 6297 tons. The armour is to be 4-inch., the deck completely plated, and beneath it is to be another deck for protecting the crew from the effects of splinters. There is to be shelter provided for the captain and the men engaged in working the big guns. There is also to be a belt formed of obturating matter rising to about 3¼ ft. above the load-line. The ship to be armed with two 19-c.m. B.L.R. guns placed one on each side in sponsons; six guns of 16 c.m., two quick-firing guns, eight machine-guns, and four torpedo-tubes. She is to have triple-expansion engines, and is to steam 20 knots. She will be fitted with two masts armed with machine-guns, her crew to be composed of 400 men, and her cost is estimated at about £360,000.

(4) MOGADOR.

The Mogador.

Out of the extra grant voted in March, 1887, provision is made for laying down at La Seyne, near Toulon, a first class protected cruiser rather larger than the Dupuy-de-Lôme class, to be called the Mogador. She will be 351 ft. long, 44 ft. wide, 20 ft. draught of water, and a displacement of 4325 tons. She will be armed with four 16-c.m. B.L.R. guns on sponsons; six 14-c.m. 6-inch B.L.R. guns, and a complement of four 3-pdr. Q.F. and six machine-guns and torpedo dischargers. Her engines will be triple expansion, of 8200 horse-power, and her speed 19 knots.

(5) SFAX.

The Sfax.

The protected cruiser Sfax, described on page 239 of *The Naval Annual* for 1866, had her steam trials off Brest in May, 1887, with the following results:—

With natural draught the horse-power developed was 4333, and the corresponding speed was 15·9 knots; with forced draught the horse-power was 6034, and the speed 16·84 knots. The vessel is ship-rigged, and has a large spread of sail. The armament consists of six 16-c.m. B.L.R. guns, four mounted on sponsons and two in recessed ports; ten 14-c.m. B.L.R. and three Q.F. guns; and five machine-guns. The coal stowage is 800 tons, and is expected to be sufficient for 6000 knots at ten-knot speed.

(6) CHANZY, DAVOUST, AND SUCHET.

The Chanzy, Davoust, & Suchet.

Three fast protected twin-screw cruisers of this class were laid down in March, 1887, the cost of which would be borne by the supplementary grant voted at that time by the Chamber.

The first ship, called the Chanzy, was laid down at St. Nazaire, and two others, the Davoust and the Suchet, at Toulon Dockyard.

The dimensions are:—Length, 297½ ft.; breadth, 40 ft.; mean draught of water, 17 ft. 6 in.; displacement, 3027 tons.

The armament will consist of four 16-c.m. B.L.R. guns, four 3-pdr. Q.F. guns, six machine-guns, and four torpedo dischargers. The horse-power of the engines will be 9000, and the expected speed 20 knots. The coal stowage will be 480 tons—sufficient for steaming 4000 knots at 12½ knots.

(7) COSMAO AND COETLOGON.

The Cosmao & Coetlogon.

These two twin-screw cruisers, similar to the Forbin and Surcouf, to be built by contract, were laid down in March, 1887, and the cost provided out of the supplementary grant.

Their dimensions are given in the alphabetical list of Unarmoured French Ships. The horse-power of the engines will be 6000, and the expected speed 19½ knots. The coal stowage will be 200 tons.

There will be a protective deck throughout, flat in the middle and sloped at the sides. Above the protective deck there will be a belt of cellulose, to prevent the influx of water when the side is pierced. This belt is about 2½ ft. thick, and formed by a thin steel bulkhead built at that distance from the ship's side.

The armament is to consist of two 14-c.m. B.L.R. guns, three Q.F. guns, four machine-guns, and five torpedo dischargers. They are schooner-rigged with four masts, and carry a considerable spread of sail.

Lalande, Tronde.

Two other vessels, similar in almost all respects to these, but on slightly different lines, called the Lalande and Tronde, are building by contract at Bordeaux.

(8) EPERVIER, FAUCON, AND VAUTOUR.

Epervier, Faucon, and Vautour.

These vessels, which are of the Condor class, described at page 238 of *The Naval Annual* for 1886, were all launched during the year 1886. The complement of men and officers is 125. The cost of each when complete in every respect is about £80,000.

(9) INCONSTANT, PAPIN, AND FULTON.

Inconstant, Papin, and Fulton.

These small composite single-screw barque-rigged cruisers were laid down in Toulon and Lorient Dockyards in 1882. They were launched in 1886–7. Their dimensions and armament are given in the alphabetical lists. The engines are of the compound three-cylinder type, and they drive a single screw. The coal capacity is 145 tons. The complement of men and officers, 116. They will all be completed in 1887. Their cost is about £37,000 each.

GERMANY.—Armoured Ships.

(Except where specially stated otherwise, all the following have hulls of iron.)

a.g.b., armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propellers.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt or Citadel.	Battery or Breastwork.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	ins.	ft.	in.						£	knots.	tons.	knots.
br.	**Arminius** . . (iron)	1583	197	4	36	0	4½	7¼ turret	9	13	10	1	1200	4 21-c.m. 10-ton B.L.R. . . .	..	1864	92,512	10·50	200	—
b.	**Baden** . . . (iron)	7400	298	0	60	0	16	10 on barbette	8	19	8	2	5600	6 26-c.m. 18-ton Krupp B.L.R., 6 M., 4 l.	..	1880	444,886	14·00	700	—
a.g.b.	**Basilisk** . . (iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1878	58,042	9·00	40	—
b.	**Bayern** . . (iron)	7400	298	0	60	0	16	10 barbette	8	19	8	2	5600	6 26-c.m. 18-ton Krupp B.L.R., 6 M., 4 l.	..	1878	406,660	14·00	700	—
a.g.b.	**Biene** . . . (iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1876	62,853	9·00	40	—
„	**Camäleon** . . (iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1878	57,564	9·00	40	—
„	**Crocodil** . . (iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1879	57,237	9·00	40	—
c.b.	**Deutschland** . (iron)	7676	280	0	62	4	10	8	10	24	7	1	8000	8 26-c.m. 22-ton B.L.R., 1 21-c.m. 13-ton do., 2 15-c.m. 4-ton do., 6 M., 4 l.	5 f. tu. or l.car	1874	412,022	14·5	710	3400
„	**Friedrich Carl** . (iron)	6007	300	0	54	6	5	4½	15	23	11	1	3500	1 21-c.m. B.L.R., 15 21-c.m. do., 6 M., 4 l.	..	1867	322,663	13·60	672	1550
t.	**Friedrich der Grosse** . (iron)	6770	307	0	53	6	9¼	8 breastwork, 10 turret	8¼	24	7	1	4930	4 26-c.m. 18-ton Krupp B.L.R., 2 17-c.m. 6-ton do., 6 M., 4 l.	..	1874	365,170	14·00	550	2500
c.b.	**Hansa** . . .(wood)	3610	235	2	45	0	6	6 to 4½	12½	21	8	1	2442	8 21-c.m. 9-ton B.L.R., 6 M., 4 l.	..	1872	183,270	12·00	300	—
a.g.b.	**Hummel** . . (iron)	1109	143	0	35	6	8	8 turret	8	10	2	1	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1881	56,741	9·00	40	—
c.b.	**Kaiser** . . . (iron)	7676	280	0	62	4	10	8	10	24	7	1	7803	8 26-c.m. 23-ton B.L.R., 1 21-c.m. 13-ton do., 2 15-c.m. 4-ton do., 6 M., 4 l.	5 f. tu. or l.car	1874	411,301	14·60	710	3400

GERMANY.—Armoured Ships—*continued.*

(Except where specially stated otherwise, all the following have hulls of iron.)

a.g.b., armoured gunboat; *b.*, barbette-ship; *br.*, broadside-ship; *c.b.*, central battery ship; *t.*, turret-ship; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propellers.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt or Citadel.	Battery or Breastwork.						Guns.	Fish Torpedo Dischargers.					
		tons.	ft.	in.	ft.	in.	inches.	inches.	ins.	ft.	in.						£	knots.	tons	knots.
br.	**König Wilhelm** (iron)	9567	355	0	60	0	8	7	10	26	7	1	8350	18 24-c.m. 14½-ton B.L.R., 5 21-c.m. 13-ton do., 2 15-c.m. 4-ton do., 6 M., 4 l.	..	1868	505,141	14·70	700	1740
c.b.	**Kronprinz** . .(iron)	5568	286	0	50	0	5	4½	16	24	3	1	4800	1 21-c.m. 12-ton B.L.R., 15 21-c.m. 9 ton do., 6 M., 4 l.	..	1867	314,836	14·30	650	—
a.g.b.	**Mücke** . . .(iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1877	60,960	9·00	40	—
„	**Natter** . . .(iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1880	52,822	9·00	40	—
b.	**Oldenburg** . (steel)	5200	246	0	59	0	13 (compound)	8 compound	..	19	6	2	3900	8 24-c.m. 18-ton Krupp B.L.R., 4 15-c.m. 4-ton do., 6 M., 2 l.	4 f. tu. or l.car	1884	235,342	13·5	250	—
t.	**Preussen** . .(iron)	6770	308	6	53	6	9	8 breast-work 10 turret	8	24	7	1	4383	4 26-c.m. 18-ton Krupp B.L.R., 2 17-c.m. do., 6 M., 4 l.	..	1873	351,904	14·00	550	2500
b.	**Sachsen** . .(iron)	7400	298	0	60	0	16	10 barbette	8	19	8	2	5600	6 26-c.m. 18-ton Krupp B.L.R., 6 M., 4 l.	..	1877	422,178	14·00	700	—
a.g.b.	**Salamander**. .(iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1880	56,914	9·00	40	—
„	**Scorpion** . .(iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1877	60,796	9·00	40	—
„	**Viper** . . .(iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1876	61,463	9·00	40	400 at 9 knots
„	**Wespe** . . .(iron)	1109	143	0	35	6	8	8 turret	8	10	2	2	700	1 30½-c.m. 35-ton B.L.R., 2 M. . .	1 f. tu.	1876	53,771	9·0	40	360 at 9 knots
b.	**Wurttemberg** .(iron)	7400	298	0	60	0	16	10 barbette	8	19	8	2	5600	6 26-c.m. 18-ton Krupp B.L.R., 6 M., 4 l.	..	1878	402,512	14·00	700	—

GERMANY.—Unarmoured Ships.

corv., corvette; *d.v.*, despatch vessel; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *to.r.*, torpedo ram; P, deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
												Guns.	Fish Torpedo Dischargers.					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
g.v.	**Adler**	884	177	2	32	10	composite	11	6	1	724	2 15-c.m. 3½-ton B.L.R., 2 12-c.m. 27-cwt. do.	..	1883	44,047	11·00	—	—
„	**Albatross**	716	168	0	26	10	wood	10	6	1	496	2 15-c.m. 3½-ton B.L.R., 2 12-c.m. 27-cwt. do.	..	1871	38,092	10·00	—	—
corv.	**Alexandrine** (²)	2373	236	3	42	7	iron, steel, and wood	18	4	1	2400	12 15-c.m. 4-ton B.L.R., 2 8·7 c.-m. 9-cwt. do., 4 M., 1 l.	1 f. tu. or l.car	1885	102,877	15·00	—	—
„	**Arcona** (²)	2373	236	3	42	7	„	18	4	1	2400	12 15-c.m. 4-ton B.L.R., 2 8·7-c.m. 9-cwt. do., 4 M., 1 l.	1 f. tu. or l.car	1885	109,875	15·00	—	—
„	**Ariadne**	1727	204	0	35	0	wood	17	4	1	2100	6 15-c.m. 3½-ton B.L.R., 2 12-c.m. 27-cwt. do., 4 M., 1 l.	..	1871	91,979	13·00	—	—
fr. cr.	Vessel to replace **Ariadne** P.	4250	308	0	46	0	steel and wood	21	0	2	8000	14 15-c.m. 4-ton B.L.R. Krupp	..	Bldg.	..	18·00	800	—
fr. cr.	**Bismarck**	2856	244	4	44	10	iron and wood	19	8	1	2529	16 15-c.m. 3½-ton B.L.R., 6 M., 2 l.	1 f. tu. or l.car	1877	136,055	13·00	—	—
d.v.	**Blitz**	1382	246	0	32	10	steel	13	5	2	2839	1 12½-c.m. 28-cwt. B.L.R., 4 8·7-c.m. 9-cwt. do., 4 M.	1 f. tu. or l.car	1882	66,935	16·00	—	—
fr.cr.	**Blucher***	2856	244	4	44	10	iron & wood	19	8	1	2990	16 15-c.m. B.L.R., 6 M., 2 l.	6 f. tu. or l.car	1877	136,408	14·00	—	—
to.r.	**Bremse** P.	866	203	5	27	10	steel	10	6	..	1500	1 21-c.m. 9-ton B.L.R.	..	1884	49,308	15·00	65	—
„	**Brummer** P.	866	203	5	27	10	steel	10	6	..	1500	1 21-c.m. 9-ton B.L.R.	..	1884	52,422	15·00	65	—
corv.	**Carola**	2169	226	4	42	7	iron and wood	18	4	1	2340	8 15-c.m. 3½-ton B.L.R., 2 8·7-c.m. 9-cwt. do., 4 M., 1 l.	..	1880	109,617	14·00	—	2000
fr.cr.	**Charlotte**	3360	244	6	45	0	iron & wood	18	6	1	3000	18 15-c.m. 4-ton B.L.R., 6 M., 2 l.	1 f. tu. or l.car	1885	..	16·00	—	—
g.v.	**Cyclop**	412	125	0	23	0	iron	8	2	1	250	2 12-c.m. 27-cwt. B.L.R., 2 8-c.m. 6-cwt. do.	..	1874	16,980	8·0	—	—
g.v.	**Eber** (to replace **Albatross**). (¹)	1550	215	10	35	0	steel and wood	15	0	..	2400	2 24-c.m. B.L.R., 2 12½-c.m. 27-cwt. do., 2 8·7-c.m. do., 4 M.	2 l. car.	1887	..	15·00	—	—

* The Blucher is used as a torpedo school.

GERMANY.—Unarmoured Ships—*continued.*

corv., corvette; *d.v.*, despatch vessel; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *to.r.*, torpedo ram; P, deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Fish Torpedo Discharger.	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
fr.cr.	**Elisabeth**	2508	216	10	41	7	wood	19	1	1	2100	19 15-c.m. 4-ton B.L.R., 6 M., 2 l. .	..	1868	103,313	12·00	—	—
„	To replace **Elisabeth** . P.	4250	308	0	46	0	steel and wood	21	0	2	8000	14 15-c.m. 4-ton B.L.R. Krupp . .	..	Bldg.	..	18·00	800	—
corv.	**Freya**	2017	259	2	35	0	„	17	4	1	2471	8 15-c.m. 3½-ton B.L.R., 4 M., 1 l.. .	..	1875	106,868	15·0	—	—
fr.cr.	**Gneisenau**	2856	244	4	44	10	iron and wood	19	8	1	2500	16 15-c.m. 3½-ton B.L.R., 6 M., 2 l. .	tu.	1879	154,445	13·00	—	—
d.v.	**Greif**	2000	318	0	32	0	steel	13	0	2	5400	2 10½-c.m. 23-cwt. B.L.R., 10 M. . .	..	Bldg.	..	19·00	—	—
„	New vessel of the same class, not named.	2000	318	0	32	0	steel	13	0	2	5400	2 10½-c.m. 23-cwt. B.L.R., 10 M. . .	..	Bldg.	..	19 00	—	—
„	**Grille**	350	170	6	24	3	wood	10	0	1	650	1 12½-c.m. 28-cwt. B.L.R., 2 8-c.m. do. .	..	1857	..	13·00	—	—
g.v.	**Habicht**	848	174	0	29	6	composite	11	5	1	875	1 15-c.m. 3½-ton B.L.R., 4 12-c.m. 27-cwt. do., 4 8·7-c.m. do.	..	1879	33,054	12·00	—	—
„	**Hyäne**.	489	139	8	25	1	iron	9	10	1	310	2 10½-c.m. B.L.R., 2 l. . . .	..	1878	24,340	9·00	—	—
„	**Iltis**	489	139	8	25	1	„	9	10	1	380	2 10½-c.m. B.L.R., 2 l. . . .	..	1878	27,480	9·00	—	—
fr.cr.	**Leipzig**	3925	282	2	45	8	iron and wood	21	7	1	3590	2 17-c.m. 5½-ton B.L.R., 10 17-c.m. 3½-ton. 6 M., 2 l.	..	1875	203,055	14·00	—	4000
l.corv.	**Luise**	1719	204	0	35	0	wood	17	4	1	2100	6 15-c.m. 3½-ton B.L.R., 2 12-c.m. 27-cwt. do., 4 M., 1 l.	..	1872	85,975	13·00	—	—
„	**Marie**	2169	226	4	42	7	iron & wood	18	4	1	2257	8 15-c.m. 3½-ton B.L.R., 2 8·7-c.m. 9-cwt. do., 4 M., 1 l.	1 f. tu. or l.car	1881	..	13·50	—	2000
fr.cr.	**Moltke**	2856	244	4	44	10	„	19	8	1	2500	16 15-c.m. 3½-ton B.L.R., 6 M., 2 l. .	1 f. tu. or l.car	1877	140,705	13·50	—	—
g.v.	**Möwe**	848	174	0	29	6	composite	11	5	1	784	1 15-c.m. 3½-ton B.L.R., 4 12-c.m. 27-cwt. do., 4 8·7-c.m. 9-cwt. do.	..	1879	33,390	12·00	—	—

g.v.	**Nautilus**	716	168	0	26	10	wood	10	6	1	496	2 15-c.m. 3½-ton B.L.R., 2 12-c.m. 27-cwt. do.	..	1871	38,147	10·00	—	—
corv.	**Olga**	2169	226	4	42	7	iron & wood (sheathed)	18	4	1	2397	8 15-c.m. 3½-ton B.L.R., 2 8·7-c.m. 9-cwt. do., 4 M., 1 l.	..	1880	113,812	14·00	—	2000
d.v.	**Pfeil**	1382	246	0	32	10	steel	13	5	2	2700	1 12½-c.m. 28-cwt. B.L.R., 4 8·7-c.m. 9-cwt. do., 4 M.	1 f. tu.	1882	73,605	15·00	—	—
fr.cr.	**Prinz Adalbert** . . .	3925	282	2	45	8	iron & wood	21	7	1	3612	2 17-c.m. 5½-ton B.L.R., 10 17-c.m. 3½-ton do., 6 M., 2 l.	..	1876	206,499	15 00	—	—
corv.	**Sophie**	2169	226	4	42	7	„	18	4	1	2100	8 15-c.m. 3½-ton B.L.R., 2 8·7-c.m. 9 cwt. do., 4 M., 1 l.	..	1881	117,155	14·00	—	2000
fr.cr.	**Stein**	2856	244	4	44	10	„	19	8	1	2707	16 15-c.m. 3½-ton B.L.R., 6 M., 2 l. .	1 f. tu. or l. car	1879	136,069	14·00	—	—
„	**Stosch**.	2856	244	4	44	10	„	19	8	1	2581	16 15-c.m. 3½-ton B.L.R., 6 M., 2 l. .	1 f. tu. or l. car	1877	126,066	13·00	—	—
d.cr.	**Swallow** (²)	1300	203	0	30	9	composite	..		2	1500	8 10½-c.m. B.L. guns	..	1887	..	13·50	—	—
corv.	**Victoria**	1825	235	9	35	4	wood	17	8	1	1300	4 15-c.m. 3½-ton B.L.R., 6 12-c.m. 27-cwt. do., 4 M., 1 l.	..	1864	84,450	13·00	—	—
g.v.	**Wolf**	489	139	8	25	1	iron	9	10	1	340	2 10½-c.m. 23-cwt. B.L.R., 2 l. . .	..	1878	24,343	9·00	—	—
d.v.	**Zieten**	975	196	10	29	6	„	11	6	1	2323	4 12-c.m. 27-cwt. B.L.R., 4 M. . .	..	1876	81,755	16·00	140	—
	2 Torpedo Gunboats (not named)	220	186	0	21	5	steel	..		2	2000	.. ..	..	Bldg.	..	19·00	—	—

There are, also, on the German list, besides stationary, surveying, harbour vessels and yachts, the following:—

One steam gunnery ship.

Two steam gunnery tenders.

One steam torpedo tender (Ulan).

One steam gunboat (Dracke).

Two steam training ships.

Eight small torpedo vessels; 50 to 140 tons, 500 to 550 I.H.P.

TORPEDO BOATS.

One—the Jäger, of 140 tons displacement, 500 H.P.

58 first-class boats 121 feet long, 16 feet broad, 85 tons displacement, and of about 20 knots speed, built in the years 1883 to 1886. Among these are those named Flink, Kühn, Scharf, Schütze, Sicher, Tapfer and Vorwärtz.

5 first-class boats are now building by Schichau, of Elbing.

49 second-class boats, about 98 feet long, 16 feet broad, 50 tons displacement, and 500 H.P.

The number of torpedo boats fixed as the final establishment is 150.

NOTES ON THE GERMAN ARMOURED AND UNARMOURED SHIPS, AND DETAILS OF CONSTRUCTION.

It would appear that the present policy of the German Government is not to maintain a large fleet of cruising ships for foreign service, but to provide small flying and instruction squadrons, and to render its own coasts safe from invasion. For this latter purpose great attention is given to the development of a torpedo flotilla, and to the acquisition of armoured coast-defence ships.

It is proposed to largely augment these two classes, and estimates have been prepared for building six large armoured gun-vessels for the defence of the mouths of the Elbe, and four others for the defence of other parts of the coast.

The estimated cost of each of these vessels is about £160,000, and it is intended to complete the first six by the time the North Sea and Baltic Ship Canal is completed.

(1) Eber.

The Eber

The vessel, which was built at the Dantzic Dockyard to replace the Albatross, has been named the Eber; she was launched in February, 1887.

Her dimensions are:—Length, 215 ft. 10 in.; breadth, 35 ft.; extreme draught of water, 15 feet; and displacement, 1550 tons. The engines are of 2400 horse-power, and the expected speed is 15 knots. Her armament consists of two 24-c.m. Krupp B.L. guns, one in the bow and one in the stern; two 12½-c.m. guns, and two 8·7-c.m. guns of the same description, four 47-mm. Hotchkiss machine-guns, and two broadside Whitehead torpedo dischargers.

(2) Alexandrine and Arcona.

The Alexandrine and Arcona.

A swift cruiser, named the Alexandrine, partially described on p. 243 of *The Naval Annual* for 1886, built at Kiel Dockyard, of iron and steel, and sheathed with wood and coppered, had her steam trials in October, 1886. The engines then developed 2400 horse-power, and a mean speed of 15 knots was obtained.

The dimensions and armament are shown in the alphabetical list, She is barque-rigged, and has a complement of men and officers of 267.

(^{3}) SWALLOW.

The Swallow.

A twin-screw vessel of a new type was launched at Wilhelmshaven in August, 1887, called the Swallow. Her dimensions are:—Length, 203 ft.; breadth, 30 ft. 9 in.; displacement, 1300 tons; indicated horse-power of engines, 1500; estimated speed, 13½ knots.

The armament consists of eight long 10½-c.m. B.L.R. Krupp guns, four firing in the direction of the keel. The complement of officers and men is 120. The vessel is intended for employment on the African coast. She was barely ten months on the stocks, and will soon be completed.

GREECE.—Armoured Ships.

br., broadside ship; *c.b.*, central-battery ship; f. tu., l. car., fixed tube or launching carriage for discharging fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Mean Draught of Water.		Propeller.	Indicated Horse power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Battery.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	ins.	ft.	in.						£	knots.	tons.	
c.b.	**King George** (iron)	1774	200	2	32	10	7	6	..	15	6	2	2400	2 21-c.m. 10-ton B.L.R. (Krupp), 2 M., 4 l.	..	1867	..	12·00	—	—
br.	**Olga** (wood)	2060	230	0	59	0	4¾	4	..	18	0	1	1950	4 17-c.m. 5½-ton B.L.R. (long Krupp), 2 17-c.m. 3½-ton do. (short), 2 M., 4 l.	..	1869	..	10·00	—	—

GREECE.—Unarmoured Ships.

corv., corvette; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; f. tu., l. car., fixed tube or launching carriage for discharging fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	
g.v.	**Acheloos**	420	138	0	24	11	steel	11	6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·00	50	—
corv.	**Admiral Miaulis**	1800	246	0	36	0	iron and wood	14	5	1	2200	3 17-c.m. B.L.R. 5½-ton (long Krupp), 1 17-c.m. 3½-ton do. (short), 2 M., 4 l.	..	1879	..	15·00	—	—
g.v.	**Alpheos**	420	138	0	24	11	steel	11	6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·00	50	—
„	**Aphroessa**	380	124	7	22	11	iron	9	10	1	160	1 8·7-c.m. B.L.R. (Krupp)	..	1858	..	9·00	—	—
„	**Eurotas**	420	138	0	24	11	steel	11	6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·00	50	—
fr.cr.	**Hellas**	1300	200	2	37	0	wood	19	4	1	1500	12 15-c.m. B.L.R. (Krupp), 2 M.	..	1878 (repaired)	..	11·00	50	—
g.v.	**Hydra**	440	124	8	29	6	steel & wood	9	6	2	380	1 26-c.m. 26-ton B.L.R. (Krupp), 2 M.	..	1881	..	10.00	—	—
cr.	**Malvina**	2240	259	0	30	0	iron	13	0	1	1670	.. ..	..	..	..	13·50	—	—
„	**Mecali (was Buzzard)**	1000	210	6	32	6	steel	..		2	1000	.. ..	..	1884	—	—	—	—
g.v.	**Nauplion**	380	124	7	22	11	iron	9	10	1	100	1 8·7-c.m. B.L.R. (Krupp)	..	1856	..	9·00	—	—
„	**Paraloe**	380	123	0	23	11	iron	9	10	1	204	1 8·7-c.m. B.L.R. (Krupp), 1 M.	..	1858	..	8·00	-	—

„	**Peneus**	420	138 0	24 11	steel	12 6	1	400	2 9·6-c.m. B.L.R. (Krupp), 3 M.	..	1884	..	10·55	50	—
„	**Plixiavra**	380	124 7	22 11	iron	9 10	1	160	1 8·7-c.m. B.L.R. (Krupp)	..	1856	..	9·00	—	—
cr.	**Salamina**	380	123 0	23 11	iron	9 10	1	200	1 8·7-c.m. B.L.R. (Krupp), 1 M.	..	1858	..	8·00	—	—
„	**Sfaktirea** (was Eldorado)	1100	235 0	30 0	steel	13 0	1	1700	.. ..	..	1885	..	14·50	100	—
g.v.	**Spezia**	440	124 8	29 6	steel & wood	9 6	2	680	1 26-c.m. 26-ton B.L.R. (Krupp), 2 M.	..	1881	..	11·30	50	—
„	**Syros**	380	124 7	22 11	iron	9 10	1	160	1 8·7-c.m. B.L.R. (Krupp)	..	..	..	9·00	18	—

Torpedo depôt ship.—Psara, 1100 tons, 500 I.H.P., 2 10-c.m. B.L.R. (Krupp) guns, 2 Whitehead torpedo-launching guns, one port on each broadside, 2 under-water torpedo tubes ahead. 14 knots speed.

Torpedo boats.—32 of several classes, 6 being sea-going, of 128 ft. long, 15 ft. 3 in. broad, of 85 tons displacement, 1000 horse-power, and 19 knots speed, built at Stettin; and 6 other first class boats, built by Yarrow, of about 100 ft. in length, of 40 tons displacement, and 620 horse-power. Twenty smaller steam-boats for torpedo purposes.

There are also four small iron steamers fitted for spar torpedoes; and five small composite custom-house steamers.

HAYTI.

(The Republic of Hayti has unarmoured ships only.) *corv.*, corvette; *g.v.*, gun-vessel; *sl.*, sloop.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Mean draught of water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Fish Torpedo Dis-chargers					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
g.v.	**22nd December**	900	208 0	29 11	iron	16 0	1	360	4 40-pdr. (Armstrong)	..	1860	..	9·00	..	..
corv.	**Dessalines**	..	185 0	32 0	„	14 9	..	..	1 7-in., 2 30-pdr., 4 34-pdr.	..	1883	..	16·00	..	..
sl.	**St. Michael**	850	162 0	33 0	„	11 0	1	120 (nominal)	1 11-in. smoothbore, 8 30-pdr.	..	1875	..	12·00	..	..
„	**1804**	600	145 0	29 0	„	10 0	1	100 (nominal)	1 10-in. smoothbore, 6 30-pdr.	..	1875	..	12·00	..	..
„	**Toussaint L'ouverture**	500	164 0	24 6	steel	9 6	..	800	1 6¼-in. B.L.R., 2 4¾-in. do., 2 M.	..	1886	..	12·00	120	3000

NOTE ON HAYTIAN SHIPS.

The Toussaint L'ouverture was built at La Seyne, near Toulon, during the year 1886. Her dimensions are—length, 164 ft.; breadth, 24 ft. 6 in.; maximum draught of water, 10 ft. 8 in. Displacement, 500 tons. The engines are of 800 horse-power, and the ship has a speed of 12 knots. She is built of steel, is brig-rigged, and her armament consists of one 16-c.m. B.L. gun on a platform in the bow, two 12 c.m. guns on sponsons, and a complement of machine-guns.

ITALY.—Armoured Ships.

a.g.b., armoured gunboat; *b.*, barbette ship; *c.b.*, central-battery ship; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Citadel or Turret.						Guns.	White-head Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	ins.	ft.	in.						£	knots.	tons.	knots.
t.	**Affondatore** . .(iron)	4376	290	0	40	0	5	5 turret	9	20	0	1	3240	2 25-c.m. 28-ton B.L.R. (Armstrong), 6 M., 4 l.	..	1865	152,480	13·00	460	1647
c.b.	**Ancona** . . .(iron)	4250	256	0	50	0	4½	4½	13¾	21	11	1	2548	2 22-c.m. 13-ton M.L.R. (Armstrong), 9 20-c.m. 7-ton do., 6 M., 6 l.	,,	1864	172,000	13·00	485	2000
b.	**Andrea Doria** (²) (steel)	11,000	328	2	65	4	18 comp.	18 comp.	..	27	2	2	10,000	4 43-c.m. 110-ton B.L.R. (Armstrong), 12 15-c.m. do., 12 M., 6 l.	5 f. tu. or l. car (2 sub)	1885	..	16·00	850	4500
c.b.	**Castelfidardo** . .(iron)	4250	256	0	50	0	4½	4½	13¾	21	11	1	2125	2 22-c.m. 13-ton M.L.R. (Armstrong), 9 20-c.m. 7-ton do., 6 M., 6 l.	..	1863	..	12·00	485	2600
t.	**Dandolo** . (iron and steel)	11,202	340	11	64	9	21½	18 turret	22¾	26	7	2	7500	4 45-c.m. 100-ton M.L.R. (Armstrong), 12 M., 6 l.	f. tu. or l. car.	1878	700,000	15·00	1279	3760
,,	**Duilio** . (iron and steel)	11,138	340	11	64	9	21½	18 turret	22¾	26	7	2	7500	4 45-c.m. 100-ton M.L.R. (Armstrong), 12 M., 6 l.	f. tu. or l. car.	1876	..	15·00	1279	3760
c.b.	**Formidabile** . .(iron)	2725	216	0	45	10	4½	4½ battery	9	18	0	1	1100	8 20-c.m. 7-ton M.L.R. (Armstrong), 4 M., 6 l.	..	1861	118,000	7·00	310	—
b.	**Francesco Morosini** (²) (steel)	11,000	328	2	65	4	18 comp.	18 comp.	..	27	2	2	10,000	4 43-c.m. 110-ton B.L.R. (Armstrong), 12 15-c.m. do., 14 M., 6 l.	5 f. tu. or l. car (2 sub)	1885	..	16·00	850	4500
,,	**Italia** (¹) . . (steel)	13,851	400	6	72	9	16-inch funnel op'nings	17 comp.	22¾	31	2	2	18,000	4 43-c.m. 110-ton B.L.R. (Armstrong), 8 15-c.m. 4-ton do., 14 M., 6 l.	4 f. tu. or l. car	1880	..	18·00	1650	8900

„	**Lepanto** (¹) .	(steel)	13,851	400	6	72	9	16-inch funnel op'nings	17 comp.	22¾	31	2	2	18,000	4 43-c.m. 110-ton B.L.R. (Armstrong), 8 15-c.m. 4-ton do., 14 M., 6 l.	4 f. tu. or l. car	1882	..	18·00	1650	8900
c.b.	**Maria Pia** .	(iron)	4268	256	0	49	4	4½	4½	13¾	22	7	1	2924	2 22-c.m. 13-ton M.L.R. (Armstrong), 9 20-c.m. 7-ton do., 6 M., 6 l.	..	1863	..	12·00	485	2600
2 batteries	**Palestro** . .	(wood)	6419	265	0	57	10	8¾	6	24	26	11	1	3496	1 28-c.m. 25-ton M.L.R. (Armstrong), 6 25-c.m. 18-ton do., 6 M., 6 l.	..	1871	..	13·00	513	1780
„	**Principe Amedeo**	(wood)	5814	265	0	57	9	8¾	6	24	26	6	1	3413	1 28-c.m. 25-ton M.L.R. (Armstrong), 6 25-c.m. 18-ton do., 6 M., 6 l.	..	1872	..	12·00	513	1780
b.	**Re Umberto** (²)	(steel)	13,251	400	0	75	0	..	18 barbettes	..	28	6	2	19,500	4 43-c.m. 110-ton B.L.R. (Armstrong), 12 15-c.m. do., 6 7½-c.m. do., 10 M.	..	Bldg.	..	18·00	1200	—
c.b.	**Roma** . .	(wood)	5814	262	6	55	9	4½	4½ battery	26	25	3	1	3000	9 22-c.m. 13-ton M.L.R., (Armstrong), 6 M., 6 l.	..	1865	..	13·00	511	1940
b.	**Ruggiero di Lauria** (²) .	(steel)	11,000	328	2	65	4	18 comp.	18 comp. barbettes	..	27	2	2	10,000	4 43-c.m. 110-ton B.L.R. (Armstrong), 12 15-c.m. do., 12 M., 6 l.	5 f. tu. or l. car (2 sub)	1884	..	16·00	850	4500
c.b.	**San Martino** .	(iron)	4268	256	0	49	4	4½	4½	14	22	7	1	2620	2 22-c.m. 13-ton M.L.R. (Armstrong), 9 20-c.m. 7-ton do., 6 M., 6 l.	..	1863	..	12·00	490	—
b.	**Sardegna** (²) .	(steel)	13,251	400	0	75	0	..	18 comp. barbettes	..	28	6	2	22,800	4 43-c.m. 110-ton B.L.R. (Armstrong), 12 15-c.m. do., 6 7½-c.m. do., 10 M.	..	Bldg.	..	19·00	1200	—
„	**Sicilia** (²) . .	(steel)	18,251	400	0	75	0	..	18 comp. barbettes	..	28	6	2	19,500	4 43-c.m. 110-ton B.L.R. (Armstrong), 12 15-c.m. do., 6 7½-c.m. do., 10 M.	..	Bldg.	..	18·00	1200	—
c.b.	**Terribile** . .	(iron)	2725	210	0	45	11	4½	4½ battery	9	18	0	1	1100	8 20-c.m. 7-ton M.L.R. (Armstrong), 4 M., 6 l.	..	1861	112,454	7·00	310	—
„	**Varese** . .	(iron)	2000	200	0	42	7	4½	4½ battery	9	15	9	2	977	4 20-c.m. 7-ton M.L.R. (Armstrong), 4 M., 6 l.	..	1865	85,000	10·00	180	—

NOTES ON THE ITALIAN NAVY.—ARMOURED SHIPS.

(1) ITALIA, LEPANTO.

The Italia, and Lepanto.

There is a brief description of the Italia and Lepanto given at p. 250 of *The Naval Annual* for 1886. A further description is now added, and with the aid of the sketches a correct idea of the ships may be formed.

The armament consists of four 110-ton B.L. guns, mounted amidships in pairs, in barbettes *en echelon*, at a height of 33½ ft. above the load water-line, and 13 ft. above the spar deck; eight 6-inch 4-ton B.L. guns on Albini carriages; fourteen machine-guns, and six light guns. They have also four Whitehead torpedo dischargers.

They have a complete armoured deck 3¼ in. thick, situated 2½ ft. below the water at the middle, and 6 ft. at the ship's side. The deck is formed of a $\frac{5}{8}$ steel plate, with a compound plate 2⅝ in. thick on top of it. The space between the double bottom and the armoured deck is divided by transverse and longitudinal bulkheads into fifty-one water-tight compartments, and before and aft the double bottom space the ship is divided into eighteen more compartments.

Between the armoured deck and the deck above the space is divided into one hundred separate water-tight compartments. The bases of the funnels are protected by an armoured glacis 16 in. thick, rising 3½ ft. above the water-line. The ammunition hoist is protected by heavy armour from the armoured deck to the barbette. The barbette is protected by 17-in. compound armour inclined at an angle of 24° from the vertical. At the steam trials during 1886 the mean speed of the Italia was 17·66 knots.

(2) SICILIA, RE UMBERTO, AND SARDEGNA.

Sicilia, Re Umberto, and Sardegna.

These ships, referred to at page 250 of *The Naval Annual* for 1886, are now being built, the Sicilia at Venice, the Re Umberto at Castellamare, and the Sardegna at Spezzia. They are 400 ft. long, 75 ft. wide, their extreme draught of water is 28 ft. 6 in., and the displacement 13,251 tons.

They carry four 110-ton B.L.R. guns in two barbettes at the middle line, one forward and the other aft. The axis of the guns are nearly 28 ft. above the load water-line. The keel of the Sicilia was laid down in January 1886.

The armoured deck will be 3½ in. thick, and the space next above it is divided in the manner described for the Italia and Lepanto. The horse-power of the engines was intended to be 19,500, and the speed of the ship 18 knots. The engines of the Re Umberto are being manufactured by Messrs. Maudslay.

Sicilia, Re Umberto, and Sardegna.

In the case of the Sardegna, the engines of which are being constructed at Naples by the Hawthorn Guppy Company, it is expected that the horse-power will be 22,800.

Before the designs of these ships were decided on, a caisson was built with three skins at the bottom, forming two water-tight spaces, and having an armoured deck. The caisson was moored in the harbour at Spezzia, and a torpedo containing a charge of 75 lbs. of gun-cotton was exploded against it at a suitable depth. The result was that two skins were broken, but the third remained intact. A similar trial was made, when one of the cells was filled with coal, and the result was the outer skin only was shattered. This trial appears to have given similar results to those made on the Resistance at Portsmouth, and described in Chapter XV. of the present volume.

(3) ANDREA DORIA CLASS.

The Andrea Doria was launched at Spezzia in November 1885. She was laid down in 1883. She is expected to be completed in the current year. She is sister to the Ruggiero di Lauria and the Francesco Morosini. The dimensions are given in the alphabetical list.

Andrea Doria Class.

The principal armament of four 110-ton B.L. guns will be carried in pairs in armoured barbettes placed at opposite corners diagonally of the citadel on the upper deck. There will be two submerged torpedo tubes, and three discharges above water. The armour is of steel, and consists of a belt about one half the length of the ship, surmounted by a rectangular central citadel. The thickness of the citadel armour is 18 inches, and of that on the bulkheads 15¾ in. The protective deck is of steel and is 3 in. thick, as is also that over the citadel.

ITALY.—Unarmoured Ships.

corv., corvette; *d.v.*, despatch vessel; *g.v.*, gun-vessel; *fr.cr.*, frigate-built cruiser; *s.g.to.*, sea-going torpedo boat; *to.cr.*, torpedo cruiser; *to.r.cr.*, torpedo-ram cruiser; *to.s.*, torpedo ship; P, deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.		Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armaments.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
													Guns.	Fish Torpedo Dis-chargers					
			tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
g.v.	A. Capellini		840	137	6	32	9	steel	—		1	800	. . . .	..	Bldg.	..	12·00	—	—
d.v.	Agostino Barbarigo		656	216	6	23	11	„	10	10	1	1700	5 3-inch B.L.R. (Armstrong), 2 M.	..	1879	..	15·00	80	1000
corv.	Amerigo Vespucci	P.	2533	255	11	42	7	„	17	0	1	5000	8 15-c.m. 4-ton B.L.R., 6 M., 3 l.	..	1882	..	15·00	500	—
g.v.	Andrea Provana		649	167	4	26	3	„	10	2	1	1000	4 5-inch B.L.R., 2 M.	..	1884	..	12·00	120	—
d.v.	Archimede (⁴)		770	230	0	26	3	„	10	0	1	1700	4 12-c.m. B.L.R., 4 M.	2 l. car	Bldg.	..	16·00	210	—
corv.	Caracciolo		1578	209	11	36	0	wood	16	8	1	973	6 16-c.m. 5-ton B.L.R., 1·8-c.m. do., 4 M., 1 l.	..	1869	..	10·00	180	—
g.v.	Cariddi		1050	177	2	28	6	„	12	5	1	956	1 16-c.m., 2 12-c.m. B.L.R., 4 M., 2 l.	..	1875	..	10·00	164	—
to.cr.	Confienza (³)		740	230	0	25	6	steel	9	0	3	3600	4 6-Pr. and 4 3-Pr. Q.F.G., 3 M.	5 f. tu. or l.car	1887	..	20·00	180	—
corv.	Cristoforo Colombo		2362	249	4	36	0	wood & iron	17	4	1	3782	8 12-c.m. B.L.R., 4 M., 2 l.	..	1875	..	15·00	471	3600
d.v.	Curtatone		1040	177	3	32	8	steel	13	6	1	1100	6 5-inch B.L.R.	..	Bldg.	..	12·00	197	—
cr.	Dogali (²)		2200	250	0	37	0	„	14	6	2	7600	6 6-inch B.L.R. (Armstrong), 9 Q.F., 6 M.	6 l. car	1887	170,000	19·66	480	—
to.r.cr.	Etna	P.	3530	282	2	42	7	„	19	0	2	6000	2 25-c.m. 28-ton B.L.R. (Armstrong), 4 15-c.m. 4-ton do., 8 M., 2 l.	4 f. tu. or l.car	1885	64,000 (engines)	19·00	630	—
„	Fieramosca (¹)	P.	3745	290	0	43	6	„	19	4	2	7700	2 25-c.m. 25-ton B.L.R., 6 6-inch 4-ton B.L.R.	6 f. tu. or l.car	Bldg.	..	17·00	590	—
corv.	Flavio Gioja	P.	2533	255	11	42	7	„	17	0	1	5000	8 15-c.m. 4-ton B.L.R. (Armstrong), 6 M., 3 l.	..	1881	..	15·00	500	—
s.g.to.	Folgore		317	187	0	19	8	..	6	7	1	2400	1 6-Pr. Q.F.G., 7 M.	..	1886	..	20·00	90	—
d.v.	Galileo (⁴)		770	230	0	26	3	„	8	2	1	1700	4 5-inch B.L.R., 4 M.	2 l. car	1887	..	16·00	210	—
fr.cr.	Garibaldi		3376	223	2	49	3	wood	20	11	1	1041	8 16-c.m. B.L.R., 2 8-c.m. do., 4 M., 4 l.	..	1860	..	9·00	330	—
to.r.cr.	Giovanni Bausan	P.	3068	275	7	42	7	steel	18	4	2	6500	2 25-c.m. 24-ton B.L.R. (Armstrong), 6 15-c.m. 5-ton B.L.R., 4 M., 2 l.	3 f. tu. or l.car (1 f. tu. sub.)	1883	160,000	17·50	600	5000
to.cr.	Goito		740	230	0	25	6	„	9	2	2	4200	4 6-Pr. and 4 3-Pr. Q.F.G., 3 M.	5 f. tu. or l.car	1887	..	20·00	180	—

d.v.	**Marcantonio Colonna**		656	216	6	28	11	„	10	10	1	1700	5 3-inch B.L.R. (Armstrong), 2 M.	..	1879	..	15·40	197	—
to.cr.	**Montebello** (*)		740	230	0	25	6	„	9	0	3	4200	4 6-Pr. Q.F.G., 7 M.	5 f. tu. or l.car	Bldg.	..	20·00	180	—
„	**Monzambano** (*)		740	230	0	25	6	„	9	0	3	4200	4 6-Pr. and 4 3-Pr. Q.F.G., 3 M.	5 f. tu. or l.car	Bldg.	..	20·00	180	—
to.s.	**Pietro Micca**		535	203	5	19	7	iron	10	6	1	972	2 M.	..	1876	..	10·00	28	—
d.v.	**Rapido**		1456	262	5	30	6	„	12	6	1	1920	5 3-inch B.L.R. (Armstrong), 2 M.	..	1876	..	13·00	300	2560
s.g.to.	**Saetta**		317	187	0	19	8	steel	6	7	1	2400	1 6-Pr. Q.F.G., 7 M.	..	1886	..	20·00	90	—
corv.	**Savoia**	P.	2850	275	6	42	7	„	17	0	1	5000	6 15-c.m. 4-ton B.L.R. (Armstrong), 6 M., 4 l.	..	1883	..	15·00	500	—
g.v.	**Scilla**		1060	177	2	28	6	wood	12	5	1	826	2 12-c.m. B.L.R. (Armstrong), 1 16-c.m., 2 l., 4 M.	..	1874	..	10·00	—	—
„	**Sebastiano Veniero**		649	167	4	26	3	steel	10	2	1	1000	6 12-c.m. B.L.R., 1 M.	..	1884	..	12·00	—	—
d.v.	**Stafetta**		1505	252	7	30	10	iron	13	2	1	1800	4 5-inch B.L.R., 2 M., 1 l.	..	1876	..	15·00	300	3300
to.r.cr.	**Stromboli**	P.	3530	282	2	42	7	steel	19	0	2	7700	2 25-c.m. 28-ton B.L.R. (Armstrong), 4 15-c.m. 4-ton do., 8 M., 2 l.	6 f. tu. or l.car	1885	64,000 (Engines)	17·00	630	—
to.cr.	**Tripoli** (*)		740	229	7	25	7	„	9	2	2	4200	4 6-Pr. and 4 3-Pr. Q.F.R., 3 M.	5 f. tu. or l.car	1887	..	*20·00	180	—
d.v.	**Vedetta**		827	183	9	26	11	iron	11	5	1	670	4 12-c.m. B.L.R., 2 M., 1 l.	..	1866	..	11·00	137	—
to.r.cr.	**Vesuvio**	P.	3530	282	2	42	7	steel	19	0	2	7700	2 25-c.m. 28-ton B.L.R. (Armstrong), 4 15-c.m. 4-ton B.L.R. 8 M., 2 l.	6 f. tu. or l.car	Bldg.	64,000 (Engines)	17·00	590	—
d.v.	(Two Vessels not named)		770	229	8	26	3	steel	8	2	1	1700	4·5 inch B.L.R.	..	Bldg. at Venice.	..	15·00	210	—
fr.cr.	**Vettor Pisani**		1800	213	8	39	4	wood	17	0	1	1004	10 12-c.m. B.L.R., 4 M., 2 l.	..	1869	..	9·00	190	—
d.v.	**Volturno**		1040	177	3	32	8	steel	13	6	1	1100	6 5-inch B.L.R.	..	Bldg.	..	12·00	197	—

(*) It is stated that the Tripoli attained a speed of 21 knots on an actual trial.

Besides the ships of which the names are given in the foregoing tables, Italy has

Gunboats (*Staunch class*).—Guardiano and Sentinella; of 265 tons, and of 231 and 260 I.H.P. respectively; 6 small gunboats of 87 tons and 52 H.P.

Paddle despatch vessels.—Esploratore, Messaggiero; of 1245 tons, 1615 I.H.P., and 15 knots speed.

Also transports, one being the Eritreo (late the America), of 9550 tons displacement, and 18 knots speed; surveying vessel, training ships, harbour and coasting-service craft, &c.

Torpedo boats.—First class, 78 built and building; of these four are 135 ft. long, 14 ft. wide, displacement 108 tons, of 25 knots speed; 28 of 118 ft. by 15 ft. wide, 84 tons displacement, and 22 knots speed; four of 65 tons displacement, and the others from 40 to 34 tons, of 19 knots speed; second class 21, all built of steel.

There are nine merchant steamers of more than 3000 tons on the auxiliary list, viz., China, Manilla, Orione, Perses, Raffaele, Rubattino, Singapore, Siris, and Washington. Of these, three are fitted for two torpedo-launching apparatus.

NOTES ON THE ITALIAN NAVY.—UNARMOURED SHIPS.

(1) FIERAMOSCA.

The Fieramosca.

This twin-screw steel-protected cruizer, just laid down at Leghorn, is similar to the Etna, Stromboli, and Vesuvio, but her dimensions have been slightly increased from those of the three ships named. The length is 290 ft., the breadth 43½ ft., and the displacement is 3745. Her engine-power and speed will also be increased, but in other respects she is the same as the other ships. The armament is to consist of two 10-in. 25-ton Armstrong B.L. guns in unarmoured barbettes forward and aft, six 6-in. guns of the same description in sponsons, eight quick-firing and heavy machine-guns. Also four fish torpedo dischargers, two submerged in the bows, and two above water on the broadside. There is a complete protective deck of steel two inches thick.

(2) DOGALI.

The Dogali.

The Dogali lightly-protected steel cruiser, built at Elswick by Sir W. Armstrong and Company, and at first called the Salaminia, was purchased by the Italian Government early in 1887; she is slightly built, much being sacrificed to obtain very high engine-power. The ship is 250 ft. long, 37 ft. broad, mean draught of water 14 ft. 6 in., and displacement 2200 tons. At the official trial the horse-power developed was 7600, and the speed 19·66 knots. Owing to the cramped accommodation on board, only a small complement can be carried mainly under a raised poop and forecastle. The armament consists of six 6-inch B.L. Armstrong guns mounted in sponsons, two on the forecastle, two on the poop, and two amidships, nine 6-pounder quick-firing guns, and six machine-guns. She has two military masts.

(3) TRIPOLI.

The Tripoli.

The first of the steel torpedo cruisers building for the Italian Navy, the Tripoli, was launched at Castellamare in September 1886. The dimensions are given in the alphabetical list of Italian un-

The Tripoli.

armoured ships. Compared with her size the engine-power is very large, viz. 4200 horses. She is propelled by three screws, and it is stated that she attained a speed of 21 knots an hour on a trial made during the current year. She has five torpedo dischargers, two at the bow, one at the stern and one on each broadside. She has eight quick-firing guns, four 6-pounders, and four 3-pounders, and three machine-guns.

(4) ARCHIMEDE, GALILEO.

Archimede, Galileo.

These two small cruisers or despatch vessels were laid down at Venice, and the Galileo was launched in May, 1887. Their dimensions are given in the alphabetical list. They are built throughout of steel, and have single screws. The armament consists of four 4¾ B.L.R. guns, four machine-guns, and two Fish torpedo dischargers. The engines will develop 1700 horse-power, and the speed will be 16 knots.

SEA-GOING TORPEDO BOAT.

A torpedo boat, built by Messrs. Yarrow and Co., Poplar, for the Italian Government, was tried in March 1887 on the measured mile at Lower Hope, below Gravesend. The boat is the first of two boats ordered, and is 140 ft. on the water line by 14 ft. beam, displacement at trial nearly 100 tons; she is propelled by twin screws and compound engines capable of indicating between 1500 and 1600 horse-power. There are two locomotive boilers of the usual torpedo boat type, placed one forward of the engine room and the other abaft. The connections are so arranged that each engine has its own pumps, condenser, and boiler quite separate. There, are, however, pipes which can be used, so that in case of one boiler being disabled the other will supply either or both engines with steam. As the stokeholds are separated from each other by the engine-room, there is a fan provided to each. The boilers are fitted with the makers' patent water-tight ashpan arrangement, which prevents the fires from being extinguished in case of sudden or serious leakage caused by the riddling of the boat by shot or other casualties. With these ashpans the craft can run a distance of 50 or 60 knots after the water has risen in the stokeholds above the fire-doors. The armament of the vessels consists of two torpedo tubes built into the bow; two torpedo tubes placed at a small angle with each other and fitted on a turntable on the after part of the deck, for firing over the sides; and two quick-firing Nordenfelt guns. The boats are fitted with double steam-steering gear, giving independent control of either bow or stern rudder. A dynamo electrical machine, driven by a

Brotherhood engine, is fitted in the galley compartment for producing the electric light, and also the air-compressing machinery for charging and expelling the Whitehead torpedoes. The safety of the boats is provided for by 11 water-tight bulkheads, each compartment having a powerful steam ejector for discharging water, in addition to its hand-pumps. Besides these precautions, there is also a centrifugal pump in the engine-room, driven by an independent engine, which circulates water through the surface condensers, and is constructed to suck water out of any one of the main compartments. The trial was successful, as the following tabulated results of six runs will show, the guaranteed speed being considerably exceeded :—

Runs.	Engines.	Steam Pressure.	Vacuum.	Revolutions.	Speed.
1	S	135	26	355	22·641
	P	135	27	373	
2	S	125	26	366	27·272
	P	132	27	364	
3	S	125	26	358	22·360
	P	130	27	373	
4	S	127	26	361	27·692
	P	133	27	376	
5	S	128	26	364	22·360
	P	134	27	378	
6	S	132	27	359	27·692
	P	132	27	369	
Means ..	—	130	26½	360½ 372	24·964

A sister vessel had her steam trials on the 14th of April, 1887, over the same course, when the mean speed obtained was 25·101 knots.

AMERICA.

The America.

This large passenger and mail steamer, belonging to the National Line, was purchased by the Italian Government early in the year 1887, and is intended to form a part of the Italian Navy, and to be used as a torpedo depot and transport. She was built in 1884 by Messrs. J. and G. Thomson, of Glasgow.

Her dimensions are—length between perpendiculars, 430 ft.; breadth, 51 ft. 3 in.; draught of water, 26 ft. 6 in.; displacement, 9550 tons.

The horse-power of the engines, which are compound-vertical three-cylinder type, is 9000, and the speed of the ship 18½ knots. She can maintain a speed of 17 knots, with a consumption of 216 tons of coals per diem. She is brig-rigged.

JAPAN.—Armoured Ships.

a.c., armoured cruiser; *br.*, broadside ship; *c.b.*, central-battery ship; f. tu., l. car., fixed tube or launching carriage for discharging Whitehead torpedoes.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Fish Torpedo Dis-chargers					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
Ram	**Adsuma** . . (iron) (was Stonewall Jackson)	1380	157 5	30 0	4	4	..	13 3	2	700	1 9-in. 13-ton M.L.R. (Armstrong), 4 6½-in. 5-ton do.	..	1864	..	9·00	..	..
c.b.	**Fu-Soo** . . . (iron)	3718	220 0	48 0	7	9	..	18 4	2	3500	4 24-c.m. 15-ton B.L.R. (Krupp), 2 17-c.m. 6-ton do., 6 l., 5 M.	..	1877	..	13·2	360	4500
a.c.	**Hi-yei** *. . (composite)	2200	231 0	40 9	4½	..	..	17 4	1	2490	3 17-c.m. 3½-ton B.L.R. (Krupp), 6 15-c.m. do.	..	1878	..	13·0	280	..
„	**Kin-go** * . (composite)	2200	231 0	40 9	4½	..	..	17 4	1	2450	3 17-c.m. 3½-ton B.L.R. (Krupp), 6 15-c.m. do.	..	1877	..	13·70	280	..
br.	**Rio-jo** . . (composite)	1459	213 3	34 5	4½	4	..	17 4	1	975	2 17-c.m. B.L.R. (Krupp), 6 70-pdr. (Vavasseur).	..	1864	..	9·00	350	..

* These are not armoured ships in the usual sense of the term. There is no armour as against end-on fire and no armoured deck.

JAPAN.—Unarmoured Ships.

corr., corvette; *cr.*, cruiser; *d.v.*, despatch vessel; *g.v.*, gun-vessel; P., deck protected throughout; *pp.*, deck protected amidships only; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.		Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
													Guns.	Fish Torpedo Dis-chargers					
			tons.	ft.	in.	ft.	in.		ft.	in.							knots.	tons.	knots.
c.r.	**Akagi**		1760	230	0	33	0	..	13	0	2	2300	4 6-inch B.L.R., 1 4¾-inch do. . . .	..	Bldg.	..	15·00	—	—
d.v.	**Amaki**		908	200	0	29	6	wood	13	9	1	720	1 15-c.m. B.L.R. (Krupp), 4 12-c.m. do. .	..	1877	..	11·00	150	—
corv.	**Asama** (training ship) .		1104	206	9	33	9	"	10	10	1	300 (nom.)	8 17-c.m. B.L.R. (Krupp), 4 4¾-in. do. (Armstrong), 4 l.	—	—	—	—	—	—
d.v.	**Gwaki**		600	146	4	25	3	"	12	2	1	650	1 15-c.m. B.L.R. (Krupp), 2 12-c.m. do. .	..	..	..	10·00	—	—
g.v.	**Banjo**		595	154	0	25	0	"	12	0	1	590	1 6-inch B.L.R., 1 4¾-inch do. . . .	..	1879	..	10·00	107	—
cr.	**Kaimon**		1490	210	0	32	0	"	16	5	1	1250	1 17-c.m. 6-ton B.L.R. (Krupp), 6 12-c.m. do., 2 l.	..	1882	..	12·00	—	—
g.v.	**Katsuraki** . . .		1476	206	9	36	0	composite	15	0	2	1600	2 17-c.m. B.L.R. (Krupp), 5 12-c.m. do.	..	1885	..	13·00	—	—
"	**Musasi**		1476	206	9	36	0	steel	15	0	2	1600	2 17-c.m. B.L.R. (Krupp), 5 12-c.m. do. .	..	Bldg.	..	13·00	—	—
cr.	**Naniwa** (1) . .	P.	3650	300	0	46	0	steel	18	6	2	7235	2 26-c.m. 28 ton B.L.R. (Armstrong), 6 15-c.m. 5-ton (Krupp), 2 Q.F., 14 M.	4 f. tu. or l.car	1885	..	18·72	800	9000 at 13 kts.
d.v.	**Nis-chin**		874	204	0	29	0	wood	14	6	1	1270	1 7-in. M.L.R. (Armstrong), 6 30-pdr. (smoothbore)	..	..	..	11·00	—	—
"	**Sei-ki**		810	200	0	30	0	wood	13	2	1	720	1 15-c.m. B.L.R. (Krupp), 4 12-c.m. do. .	..	1875	..	11·00	130	—
cr.	**Takao**		1760	230	0	33	0	composite	13	0	2	2330	4 6-in. B.L.R., 1 4¾-in. do. . . .	..	1885	..	15·00	—	—
"	**Takachiho** (1) . .	P.	3650	300	0	46	0	steel	18	6	2	7500	2 26-c m. 28-ton B.L.R. (Armstrong), 6 15-c.m. 5-ton do., 2 Q.F., 14 M.	4 f. tu. or l.car	1885	..	18·72	800	9000 at 13 kts.
corv.	**Ten-rio**		1490	200	0	32	0	wood	16	5	1	1250	1 17-c.m. 6-ton B.L.R. (Krupp), 6 12-c.m. do., 2 l.	..	1882	..	12·00	—	—
cr.	**Tscho-kai**		1350	210	0	32	3	steel	15	0	2	2700	1 10-in. 25-ton B.L.R., 4 4-in. do. . .	..	Bldg.	..	16·00	250	—

„	**Tsukushi**		1500	210	0	35	2	steel	15	0	2	2887	2 10-in. 25-ton B.L.R. (Armstrong), 4 5-in. 4-ton do., 4 M., 2 l.	2 f. tu. or l.car	1882	..	17·00	25	
„	**Unebi** (2)	P.	3650	321	6	43	0	steel	18	9	2	6000	4 24-c.m. 18-ton B.L.R., 4 15-c.m. 5-ton do., 12 M.	4 f. tu. or l.car	1886	..	18·50	—	—
g.v.	**Yamato**		1476	206	9	36	0	composite	15	0	1	1600	2 17-c.m. B.L.R. (Krupp), 5 12-c.m. do., 2 M.	2 f. tu. or c r	1885	..	13·00	—	—
cr.	Two ships not named (3)	*pp.*	4140	295	0	50	6	steel	21	2	2	5400	1 32-c.m. B.L.R., 11 12-c.m. do. 6 Q.F., 12 M.	4 f. tu. or l.car	Bldg.	..	16·00	—	—

Paddle despatch vessel.—Jungei, 1465 tons; 1430 horse-power; Kasuga, 1015 tons; 300 nominal horse-power.

Gunboats.—Dai-itschi-Teibo, Ho-scho, Moschum, Raiden, Tschintagata; 100 to 375 tons; 60 to 80 nominal horse-power; and the Atago and Maja, 620 tons and 700 indicated horse-power; 3 B.L. guns.

Torpedo boats.—See (4) page 368.

Three sea-going torpedo boats of 110 tons, and 19 to 20 knots.

Thirty other first class boats and 21 second class boats.

Also yachts, training-ships, transports, &c.

NOTES ON THE JAPANESE NAVY.

(1) NANIWA AND TAKACHIHO.

The Naniwa and Takachiho.

These vessels were briefly described at page 253 of *The Naval Annual* for 1886. Further particulars are now given. The principal dimensions are: Length, 300 ft.; breadth, 46 ft.; and draught 18 ft. 6 in.; with a displacement of about 3650 tons. The vessels are constructed of steel throughout. Over the entire length and covering the machinery, boilers, magazines, and steering gear, there is a strong protective deck about 3 in. thick, extending amidships from about 1 ft. above the water-line to 4 ft. below. The hull is divided throughout into numerous water-tight compartments. The ship is fitted with two military masts, mounting two Gatling guns behind shields in each top, but no sails are carried.

The armament is placed on the upper deck and is powerful. At the bow and stern two 35-calibre 10-in. guns are mounted on revolving centre-pivot carriages, giving an uninterrupted arc of fire of 240 deg. The mountings, which were designed at Elswick, present many novel points. The training is effected by means of hydraulic engines placed directly under each gun beneath the protective deck, so as to be secure from injury. A shaft is led up to the deck and engages by means of a pinion in a rack fixed to the base of the revolving carriage. There are two engines to a gun, each capable by itself of performing the rotation—a duplication of parts which greatly diminishes the risk of accident. The working platform, which is in rear of the gun, provides space for the crew and contains the mechanism connected with the elevation and training; it revolves with the carriage, the crew being sheltered by a steel shield. The carriage is fitted with Vavasseur compressors, and the gun, after discharge, returns automatically into position of firing. The elevation is easily performed by simple gearing, whilst the loading is carried out at a fixed station placed amidships and protected by stout steel armour, within which are situated the hydraulic rammer and hoists for the charges and projectiles.

Spaced along each broadside on sponsons are six 6-in. guns, also 35 calibres in length, with a horizontal range of 130 deg., mounted on Vavasseur centre-pivot automatic carriages, covered by steel shields, and along the upper works at every available space are

The Naniwa and Takachiho.

placed a large number of Nordenfelt machine guns. On the ends of the bridge are situated two 6-pounder rapid fire guns.

A conning tower of steel armour stands on the forward bridge and within it are placed the engine-room, telegraphs and various voice tubes, the hydraulic steering wheel, the directors for simultaneous electric firing of the guns, &c.

Four powerful arc lights are placed on elevated stations at either end of the forward and after bridges, capable of covering with their rays the entire space surrounding the ship. The engine-rooms, stokeholds, magazine and shell-rooms, and other compartments below the protective deck, are illuminated by incandescent electric lamps, as are also the coal bunkers on that deck and the captain's state-rooms.

The total coal stowage is 800 tons, capable of driving the ship about 9000 miles at a speed of 13 knots.

The number of officers and crew is about 325.

At the official trial of the Naniwa a mean speed of 18·72 knots was obtained with 7235 indicated horse-power.

(2) UNEBI.

The Unebi.

The Unebi fast protected twin-screw cruiser referred to at page 253 of *The Naval Annual* for 1886, and built at Havre for the Japanese Government, was launched on the 5th of April, 1886, and left Singapore for Yokohama in December of the same year. The ship was built of steel and of the following dimensions:—Length, 321½ ft.; breadth, 43 ft.; mean draught of water, 18 ft. 9 in.; displacement, 3650 tons. The armament consisted of four 24-centimetre B.L.R. guns, four 15-centimetre B.L.R. guns, machine-guns, and four tubes or launching carriages for Whitehead torpedoes. A steel protective deck, 2½ in. thick, covered the machinery and magazine spaces.

In September, 1886, she completed her steam trials very satisfactorily. The horse-power obtained was 7000, and the mean speed 18½ knots.

It appears that nothing has been heard of this ship since she left Singapore at the date above named.

(3) COAST DEFENCE CRUISERS.

The Japanese Government in January of this year ordered two Coast Defence ships to be built by contract at La Seyne, near Toulon, from the designs of their engineer, M. Bertin.

They are to be 295 ft. long, 50 ft. 6 in. wide, extreme draught of water 21 ft. 2 in., and displacement 4140 tons. The horse-power of the triple expansion engines is to be 5400 and the speed 16 knots. The armament will consist of one 32-centimetre B.L.R. gun, eleven 12-centimetre guns of the same description, six quick-firing guns, and twelve machine-guns. Also four fish torpedo dischargers — one forward, one aft, and one on each broadside. A heavy protective steel deck will protect the vitals of the ship.

(4) SEA-GOING TORPEDO BOAT, BUILT BY MESSRS. YARROW.

This vessel, which has some of her vital parts protected with one-inch steel plates, is 166 ft. long by 19 ft. beam, and she will be propelled by twin screws driven by engines indicating 1400 horse-power, from which a speed of nineteen to twenty knots an hour may be reasonably expected. The vessel has already been shipped in pieces to Japan, where she will be put together. The armament will consist of two torpedo tubes placed forward for direct ahead firing, the torpedoes being ejected by gunpowder. There will also be amidships and aft, on the deck, turntables, upon each of which will be mounted two torpedo guns, placed at an acute angle with one another and arranged for firing over the side. These guns by being nearly but not quite parallel with each other, if fired simultaneously, will very materially increase the probability of the vessel aimed at being hit.

MEXICO.—Unarmoured Ships.

g.v., gun-vessel.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
g.v.	**Democrata**	450	140	0	24	10	iron	11	2	1	600	2 6½-in. 4-ton M.R.L., 2 20-pdr. B.L.R. (Vavasseur)	..	1875	..	11·00	..	—
,,	**Mexico**	450	140	0	24	10	,,	11	2	1	600	2 6½-in. 4-ton M.R.L., 2 20-pdr. B.L.R. (Vavasseur)	..	1875	..	11·00	..	—

Mexico has also two 10-knot gunboats of small size, the Independencia and the Libertad.

NETHERLANDS.—Armoured Ships.

a.g.b., armoured gunboat; *c.s.*, coast-service vessel; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Turret.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
c.s.t.	**Bloedhond** . (iron)	1530	180	0	46	8	5½	8	9¾	9	6	2	680	1 28-c.m. 28-ton B.L.R. (Krupp), 2 M.	..	1869	..	8·50	90	—
,,	**Buffel** . . (iron)	2198	195	6	40	0	6	8	9¾	15	6	2	2000	2 23-c.m. 13-ton M.L.R. (Armstrong), 2 M.	..	1868	..	12·40	150	—
,,	**Cerberus** . . (iron)	1530	180	0	44	0	5½	8	9¾	9	7	2	617	1 28-c.m. 28-ton B.L.R. (Krupp), 2 M.	..	1869	..	8·50	90	—
,,	**Draak** . . (iron)	2156	201	5	49	3	8	9	11¾	10	10	2	807	2 28-c.m. B.L.R. (Krupp), 2 M. .	..	1877	..	8·00	100	—
,,	**Guinea** . . (iron)	2378	195	6	40	0	6	8	9¾	16	9	2	2000	2 23-c.m. 13-ton B.L.R. (Armstrong), 2 M.	..	1870	..	12·00	135	—
c.s.t.	**Haai** . . (iron)	1566	186	4	44	0	5½	8 5½ C. T.	9¾	10	2	2	672	2 23-c.m. 13-ton B.L.R. (Armstrong), 2 M.	..	1871	..	7·00	70	—
,,	**Heiligerlee** . (iron)	1530	180	0	43	7	5½	8 4½ C. T.	9¾	9	6	2	630	2 23-c.m. 13-ton B.L.R. (Armstrong), 2 M.	..	1868	..	8·00	90	—
,,	**Hijena** . . (iron)	1566	186	4	44	0	5½	8 5½ C. T.	9¾	10	2	2	654	2 23-c.m. 13-ton M.L.R. (Armstrong), 2 M.	..	1871	..	7·00	70	—
a.g.b.	**Isala** . . (iron)	367	150	11	24	11	4	5	5	4	3	2	306	2 12-c.m. B.L.R. (Krupp) .	..	1876	..	7·00	27	—
t.	**Koning der Nederlander** (iron)	5400	269	0	49	3	8	9 8 Pt. House.	11¾	20	0	2	4500	4 28-c.m. 25-ton M.L.R. (Armstrong), 4 12-c.m. B.L.R. (Krupp)	..	1874	..	11·00	620	—
c.s.t.	**Krokodil** . (iron)	1530	180	0	43	7	5½	8 4½ C. T.	9¾	9	6	2	630	2 23-c.m. 13-ton B.L.R. (Krupp), 2 M.	..	1868	..	8·00	90	—
,,	**Luipard** . . (iron)	1525	186	4	44	0	5½	8 5½ C. T.	9¾	9	2	2	680	1 28-c.m. 28-ton B.L.R. (Krupp), 2 M.	..	1876	..	7·00	70	—
,,	**Matador** . . (iron)	1935	201	5	49	3	5½	9	9¾	10	2	2	691	2 28-c.m. 28-ton B.L.R. (Krupp), 2 M.	..	1878	..	7·00	100	—

a.g.b.	**Merva** . . .	(iron)	367	150	11	24	11	4	5	5	4	3	2	395	2 12-c.m. B.L.R. (Krupp) . .	..	1879	..	7·00	27	—
„	**Mosa** . . .	(iron)	367	150	11	24	11	4	5	5	4	3	2	400	2 12-c.m. B.L.R. (Krupp) . .	..	1878	..	7·00	27	—
c.s.t.	**Panter** . .	(iron)	1566	186	4	44	0	5½	8 5½ C. T.	9¾	10	2	2	660	2 23-c.m. 13-ton B.L.R. (Armstrong), 2 M.	..	1870	..	7·00	70	—
t.	**Prinz Hendrik der Nederlander**	(iron)	3375	229	7	42	7	4½	5½	9¾	18	1	1	2000	4 23-c.m. 13-ton M.L.R. (Armstrong), 4 12-c.m. B.L.R. (Krupp)	..	1866	..	12·00	350	—
a.g.b.	**Rhenus** . .	(iron)	367	150	11	24	11	4	5	5	4	3	2	310	2 12-c.m. B.L.R. (Krupp) . .	..	1877	..	7·00	27	—
c.s.t.	**Schorpioen** .	(iron)	2175	193	3	38	0	6	8 4½ Pt. Tower.	11¾	15	10	2	2225	2 28-c.m. 28-ton B.L.R. (Krupp) .	..	1868	..	12·00	200	1030
„	**Stier.** . .	(iron)	2069	194	10	38	0	6	8 4½ P. T.	9¾	15	6	2	2257	1 28-c.m. 28-ton B.L.R. (Krupp), 2 M.	..	1868	..	12·40	160	—
„	**Tijger** . .	(iron)	1414	187	0	44	0	5½	8 4½ C. T.	9¾	8	10	2	684	2 23-c.m. 13-ton M.L.R. (Armstrong), 2 M.	..	1868	..	8·60	70	—
a.g.b.	**Vahalis** . .	(iron)	340	120	5	27	6	4½	..	7	5	3	2	243	2 7½-c.m. B.L.R. (Krupp) . .	..	1870	..	6·00	22	—
c.s.t.	**Wesp** . .	(iron)	1566	186	4	44	0	5½	8	9¾ 5½ C. T.	10	2	2	744	1 28-c.m. 28-ton B.L.R. (Krupp), 2 M.	..	1871	..	7·00	70	—

NETHERLANDS.—Unarmoured Ships.

((I) denotes vessels of the Dutch Indian Navy.)
corr., corvette; *fr.cr.*, frigate-built cruiser; *cr.*, cruiser; *g.v.*, gun-vessel; *sl.*, sloop.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Torpedo Dis-chargers	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at ten knots.
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
sl.	**Alkmaar** . . .	1010	154	3	30	2	composite	15	9	1	830	1 15-c.m. B.L.R., 6 12-c.m. do. (Krupp) .	..	1874	..	10·00	—	—
g.v.	**Arend (I)** . . .	340	125	0	21	0	"	10	0	1	320	2 3-inch M.L., 2 l.	..	1880	..	10·50	—	—
"	**Argus (I)** . . .	270	102	0	22	3	iron	8	0	1	170	.. ..	..	1868	..	8·00	60	—
"	**Aruba** . . .	770	147	7	29	6	composite	12	5	1	413	1 15-c.m. M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp), 2 M.	..	1873	..	9·00	100	—
fr.cr.	**At-jeh** . . .	3160	262	5	39	4	iron & wood	20	7	1	2700	6 17-c.m. 6-ton B.L.R., 8 12-c.m. do. (Krupp), 6 M.	..	1876	..	14·50	380	3000
g.v.	**Bali (I)** (was Eustatius) . . .	853	147	7	29	6	"	11	10	1	516	1 15-c.m. B.L.R., 3 12-c.m. do. (Krupp), 2 M.	..	1878	..	9·50	100	—
"	**Banda (I)** . . .	695	137	10	27	7	composite	11	10	1	198	1 16-c.m. M.L.R., 2 12-c.m. B.L.R. (Krupp) .	..	1872	..	9·00	80	—
"	**Bandjermassin (I)** .	732	137	10	28	10	"	11	10	1	370	1 18-c.m. 7-ton M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp).	..	1874	..	9·50	85	—
"	**Batavia (I)** . . .	853	147	7	29	6	iron & wood	11	10	1	405	1 18-c.m. 7-ton M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp).	..	1876	..	9·00	100	—
"	**Bencoolen (I)** . .	853	147	7	29	6	"	11	10	1	516	1 15-c.m. B.L.R., 3 12-c.m. do (Krupp) .	..	1879	..	9·60	100	—
"	**Bonaire** . . .	853	147	7	29	6	iron & wood	11	10	1	412	1 15-c.m. B.L.R., 8 12-c.m do. (Krupp), 2 M.	..	1877	..	9·00	100	—
"	**Ceram (I)** . . .	550	157	4	25	4	steel	10	6	1	650	3 12-c.m. B.L.R. (Krupp), 4 M. .	..	Bldg.	..	11·00	60	—
"	**Condor (I)** . . .	320	126	0	21	0	composite	10	0	1	300	2 2½-in. B.L.R., 2 6-Pr. Q.F. . . .	..	1885	..	10·00	25	—
corr.	**Curaçoa (I)**. . .	2030	190	3	33	4	wood	18	4	1	680	8 16-c.m. M.L.R.	..	1863	..	—	—	—
fr.cr.	**De Ruyter** . . .	3160	262	5	39	4	iron & wood	20	7	1	3305	6 17-c.m. 6-ton B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1880	..	14·50	380	3000
g.v.	**Flores (I)** . . .	550	157	0	25	6	steel	10	6	1	650	8 4¾-in. 2-ton B.L.R.	..	Bldg.	..	11·00	60	—
"	**Halik (I)** . . .	..	125	0	20	0	composite	10	0	1	..	.. ..	..	1878	..	8·50	—	—

cr.	**Java**	1100	197	0	31	3	iron & wood	12	3	1	1020	1 6-in. B.L.R., 3 4¾-in. do.	..	1885	..	10·60	125	—
fr.cr.	**Johan Willem Friso** (¹)	3160	262	5	39	4	„	20	7	1	3000	6 17-c.m. 6-ton B.L.R., (Krupp), 8 12-c.m. do. 4 M.	..	1886	..	14·50	380	3000
„	**Koningin Emma der Nederlanden**	3160	262	5	39	4	„	20	7	1	2750	6 17-c.m. 6-ton B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1879	..	14·60	380	3000
corv.	**Leeuwarden**	2030	190	3	39	4	wood	18	4	1	738	4 16-c.m. B.L.R., 6 12-c.m. do. (Krupp), 2 M.	..	1861	..	8·00	—	—
g.v.	**Macassar** (I)	853	147	7	29	6	iron & wood	11	10	1	394	1 18-c.m. 7-ton M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1876	..	9·00	100	—
„	**Madura** (I)	853	147	7	29	6	„	11	10	1	559	1 15-c.m. B.L.R., 3 12-c.m. do. (Krupp)	..	1880	..	9·70	100	—
„	**Padang** (I)	853	147	7	29	6	„	11	10	1	409	1 15-c.m. B.L.R., 3 12-c.m. do. (Krupp)	..	1878	..	9·40	100	—
„	**Palembang** (I)	732	137	10	28	10	composite	11	10	1	370	1 18-c.m. 7-ton M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1874	..	8·50	85	—
„	**Pontianak** (I)	832	147	7	29	6	„	11	10	1	360	1 18.-c.m. 7-ton M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1873	..	8·50	85	—
„	**Riow** (I)	832	147	7	29	6	„	11	10	1	204	1 16-c.m. M.L.R., 2 12-c.m. B.L.R. (Krupp)	..	1872	..	8·00	80	—
„	**Samarang** (I)	853	147	7	29	6	iron & wood	11	10	1	460	1 18-c.m. 7-ton M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1876	..	9·00	100	—
„	**Sambas** (I)	732	137	10	28	10	composite	11	10	1	374	1 18-c.m. 7-ton M.L.R. (Armstrong), 2 12-c.m. B.L.R. (Krupp)	..	1874	..	8·50	85	—
„	**Sommelsdijk**	890	147	7	31	2	iron & wood	11	9	1	732	1 15-c.m. B.L.R., 3 12-c.m. do. (Krupp), 2 l.	..	1882	..	10·00	95	—
„	**Surinam**	853	147	7	29	6	„	11	10	1	440	1 15-c.m. B.L.R. (Krupp), 3 12-c.m. do., 2 l.	..	1877	..	9·00	95	—
fr.cr.	**Tromp**	3160	262	5	39	4	„	20	7	1	2772	6 17-c.m. 6-ton B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1877	..	14·30	380	3000
g.v.	**Valk** (I)	340	123	0	21	0	composite	10	0	1	320	2 3-inch B.L.R., 2 2-inch do.	..	1880	..	10·50	—	—
corv.	**Van Galen**	2160	193	6	41	6	wood	18	2	1	833	4 16-c.m. B.L.R., 6 12-c.m. do. (Krupp), 2 M.	..	1872	..	10·00	—	—
fr.cr.	**Van Speyk**	3160	262	5	39	4	iron & wood	20	7	1	3000	6 17-c.m. 6-ton B.L.R., 8 12-c.m. do. (Krupp), 4 M.	..	1882	..	14·20	380	3000
g.v.	**Zeemeeuv** (I)	340	125	0	20	0	composite	10	6	1	..	.. ..	..	1878	..	8·00	—	—
corv.	**Zilveren Kruis**	2160	193	6	41	7	wood	18	4	1	1440	4 16-c.m. B.L.R., 6 12-c.m. do. (Krupp), 4 M.	..	1869	..	10·00	—	—
g.v.	**Zwalur** (I)	340	123	0	21	0	composite	10	0	1	320	2 3-inch B.L.G., 2 2-inch do.	..	1882	..	10·50	—	—

Gunboats (*Staunch class*).—Balder, Braga, Bulgia, Dufa, Freijr, Hadda, Hefring, Heimdall, Njord, Thor, Tijr, Udur, Ulfr, Vali, Vidr, Wodan, of 245 tons; also, Bever, Brak, Das, Dog, Ever, Fret, Geep, Gier, Havik, Hydra, Lynx, Raaf, Sperwer, Vos, of 195 tons.

Steel gunboat.—"No. 3," 108 tons and 172 I.H.P.

First-class torpedo boats, four seagoing, of 73 tons displacement and 20 to 21 knots (built and building); two of 46 tons displacement and 21 knots; and 20 boats of 29 tons displacement and 17 knots.

Also several large paddle steamers, training ships, transports, store-ships, surveying vessel, &c.

NOTES ON THE NETHERLANDS NAVY.—UNARMOURED SHIPS.

(1) JOHAN WILLEM FRISO.

Johan Willem Friso.

The Johan Willem Friso, the last of six large cruisers, was laid down in 1883, and was launched during 1886. Her sisters are the Atjeh, Tromp, Koningin Emma der Nederlanden, De Ruyter and Van Speyk. They are all built of iron and steel, sheathed with wood to four feet above the load water-line, and coppered. They are all full-rigged ships. Their dimensions are given in the alphabetical list of unarmoured ships. The armament of each is six 17-centimetre Krupp B.L. guns, one forward, one abaft, and two on each broadside, eight 12-centimetre guns of the same kind on the broadside, and six machine guns.

The horse-power of the engines is about 3000, and the speeds at the mile varied from 14·1 knots to 14·7 knots. The coal supply is 380 tons—sufficient to enable them to steam above 3000 knots at a 10-knot speed. The complement of men and officers is 340.

NORWAY.—Armoured Ships.

c.s.,t., coast-service turret ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Turret.	Belt.					Guns.	Fish Torpedo Dis-chargers					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.s., t.	**Mjolner** .	1515	203 5	45 11	12	5	39	11 10	1	450	2 27-c.m. 18-ton M.L.R. (Armstrong), 1 M., 1 l.	..	1868	66,800	8·00	138	—
”	**Skorpionen**	1447	200 2	45 11	12	5	39	11 6	1	350	2 27-c.m. 18-ton M.L.R. (Armstrong), 1 M., 1 l.	..	1866	..	6·00	138	—
”	**Thor** . .	2003	203 5	49 3	14¼	7	38	13 2	1	600	2 27-c.m. 20-ton M.L.R. (Armstrong), 1 M., 1 l.	..	1872	..	8·00	200	—
”	**Thrudvang**.	1515	200 2	45 11	12	5	39	11 10	1	500	2 27-c.m. 18-ton M.L.R. (Armstrong), 1 M., 1 l.	..	1867	..	8·00	138	—

NOTE.—All the above ships are built of iron.

NORWAY.—Unarmoured Ships.

corv., corvette; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Fish Torpedo Dis-chargers					
		tons.	ft. in.	ft. in.		ft. in.						£	tons.	tons.	knots.
g.v.	**Ellida**	1000	187 0	32 8	wood	14 4	2	900	5 15-c.m. 4-ton Krupp, 1 12-c.m. do., 1 l., 2 M.	1 f. tu. or l.car	1880	..	12·00	97	—
fr.cr.	**Kong Sverre** . .	3472	252 7	49 3	”	22 4	1	1800	2 20-c.m. 7-ton M.L.R. (Armstrong), 4 17-c.m. M.L.R., 16 16-c.m. do., 22 8-in. smooth-bore, 6 l.	..	1860	..	11·00	377	—
corv.	**Nord Stjernen** . .	1609	216 6	39 4	”	17 9	1	800	4 16-c.m. 3-ton M.L.R., 10 8-in. smooth-bore, 3 l.	..	1862	..	9·00	195	—
sl.	**Nornen** . . .	958	173 10	36 0	”	15 9	1	280	4 16-c.m. M.L.R., 10 8-in. smooth-bore, 3 l. .	..	1855	..	7·00	54	—
fr.cr.	**St. Olaf**. . . .	2182	229 7	42 7	”	18 9	1	1200	1 20-c.m. 7-ton M.L.R. (Armstrong), 1 17-c.m. 5-ton, M.L.R., 12 16-c.m. 3-ton do., 20 8-in. 3-ton smooth-bores, 4 l.	..	1856	..	10·00	200	—
g.v.	**Sleipner** . . .	580	173 10	25 11	iron	9 6	2	800	1 26-c.m. 22-ton B.L.R., 1 15-c.m. 4-ton do. (Krupp), 1 M.	1 f. tu. or l.car	1877	..	12·00	80	—

NOTES ON THE NORWEGIAN NAVY.

Eleven Gunboats.—Brage, Glommen, Gor, Lougen, Nor, Riukan, Sarpen, Tyr, Uller, Vale, Vidar (189 to 280 tons; 100 to 450 indicated horse-power).

Sixteen smaller Gunboats.—Aasgardsrand, Arendal, Brevig, Dverg, Horten, Karmo, Kongsberg, Kristiansand, Langesund, Laurvig, Lillesand, Nök, Porsgrund, Skien, Skudernoes, Tönsberg (55 tons, 70 indicated horse-power); each armed with 1 5½-inch gun. Trold (97 tons; 65 indicated horse-power); also several smaller gun boats.

Torpedo boats.—Six first-class; one second-class; and one Miner.

Paddle steamer, transport, training ships, &c.

PERU.

Since the war with Chili the Peruvian Navy has been much reduced, and comprises only the following seagoing steamers:—

Diogenes and Lima (late Socrates), built in 1881, of 1700 tons displacement, 1800 horse-power, and 16-knot speed; also Callao, Colon, Duque de Guisa, Iquique, Lerzundi, Rimac (2100 tons, 13 knots), Tumbez, and the training frigate Apurimac.

PERSIA.

d.v., despatch vessel.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Fish Torpedo Dis-chargers					
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
d.v.	**Persepolis**	1200	206 9	34 2	steel	19 7	1	454	1 10-c.m. B.L.R. (Krupp), 4 7-c.m. do	..	1885	..	10·00	—	—

Also one small double-screw steamer for police duties, and a small 7-knot gunboat.

PORTUGAL.—Armoured Ship.

c.b., central battery-ship.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Mean Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Fish Torpedo Dis-chargers					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
c.b.	**Vasco da Gama** (iron)	2422	200 0	40 0	9	10	..	18 0	2	3605	2 26-c.m. 18-ton B.L.R. (Krupp), 2 15-c.m. do., 3 40-pdr. B.L.R. (Armstrong), 1 M.	..	1876	103,800	13·20	800	—

PORTUGAL.—Unarmoured Ships.

corv., corvette; *g.v.*, gun-vessel; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
corv.	Affonso de Albuquerque	1111	205	0	33	2	iron & wood	12	3	1	1055	2 6-in. B.L.R. (Armstrong), 5 5-in. do., 3 M.	..	1884	..	12·00	150	—
„	Bartholomeu Dias	1243	207	0	37	5	wood	20	6	1	400 (nom.)	1 6-in. B.L.R., 10 40-pdrs.	..	1858	..	10·00	360	—
g.v.	Bengo	462	125	7	24	7	composite	8	10	1	400	1 6-in. B.L.R., 2 15-c.m. do.	..	1879	..	10·00	80	—
„	Cacongo	580	141	0	24	9	„	10	8	1	400	2 6-in. 4-ton B.L.R.	..	Bldg.	—	—	—	—
„	Diego Cam	587	143	0	25	11	„	10	10	1	400	2 15-c.m. 4-ton B.L.R.	..	Bldg.	..	9·00	—	—
„	Douro	587	143	0	25	11	„	10	10	1	400	2 15-c.m. 4-ton B.L.R.	..	1873	..	9·00	80	—
corv.	Duque de Terceira	1418	180	2	34	2	wood	14	9	1	220 (nom.)	1 17-c.m. M.L.R. (Armstrong), 4 40-pdr. do.	..	1864	..	10·00	200	—
„	Estephania	2368	202	5	41	4	„	17	8	1	400 (nom.)	9 80-pdr. M.L. (Palliser)	..	1859	..	10·00	360	—
g.v.	Liberal	500	140	0	25	10	iron & wood	11	0	1	500	1 6-in. 4-ton B.L.R. (Armstrong), 6 M., 2 l.	..	1884	..	10·00	90	—
corv.	Mindello	1124	169	11	35	9	composite	13	5	1	900	2 7-in. 4-ton M.L.R. (Armstrong), 4 20-pdr. do. 2 l.	..	1876	..	11·00	100	—
g.v.	Mondovi	462	125	7	24	7	iron & wood	8	10	1	400	1 6-in. B.L.R., 2 M., 2 l.	..	1879	..	10·00	80	—
„	Quanza	587	143	0	25	11	composite	10	10	1	100 (nom.)	3 15-c.m. 4-ton B.L.R.	..	1877	..	8·00	80	—
corv.	Rainha de Portugal	1124	169	11	35	9	„	13	5	1	900	2 7-in. M.L.R. (Armstrong), 4 20-pdr. do., 2 l.	..	1876	..	11·00	100	—
g.v.	Rio Ave	380	120	0	22	0	„	10	0	1	800	1 64-pdr. M.L.R., 2 40-pdr. do.	..	1880	..	8·00	65	—
„	Rio Lima	610	148	11	28	3	iron & wood	10	6	1	500	1 15-c.m. 4-ton B.L.R. (Armstrong), 4 40-pdr. do.	..	1875	..	10·00	90	—
„	Sado	610	148	11	28	3	„	10	6	1	500	1 15-c.m. 4-ton B.L.R. (Armstrong), 4 40-pdr. do.	..	1875	..	10·00	90	—
„	Tamega	610	148	11	28	3	„	10	6	1	500	1 15-c.m. 4-ton B.L.R. (Armstrong), 4 40-pdr. do.	..	1875	..	10·00	90	—
„	Tejo	587	143	0	25	11	wood	10	10	1	400	2 15-c.m. 4-ton B.L.R.	..	1869	..	10·00	80	—
„	Vouga	721	161	0	27	7	iron & wood	11	10	1	600	1 6-in. B.L.R., 2 M., 4 l.	..	1882	..	9·00	100	—
„	Zaire	500	140	0	25	10	„	11	10	1	500	1 6-in. B.L.R. (Armstrong), 6 M., 2 l.	..	1884	..	10·00	20	—
„	Zambezia	590	143	0	26	0	composite	10	10	1	400	2 6-in. B.L.R., 6 M.	...	1886	..	9·00	80	—

Gunboats.—Two building of steel, of 220 tons displacement and 380 horse-power.

Torpedo boat.—Espadarte, of 19 knots speed.

Three torpedo boats, 110 feet long, 12 feet broad, 65 tons displacement, 700 indicated horse-power, 20 knots speed, built at Poplar in 1886.

Torpedo vessel.—Fulminante.

Three transports, seven screw steamers built and building, besides training ships, yachts, &c.

ROUMANIA.

The Kingdom of Roumania has—

Five gunboats of small size (45 to 110 tons).
Two paddle yachts, Romania and Stefancel Mare.
One screw steamer (2 guns, 2 machine guns).
One towing torpedo steamer.
Two second-class torpedo boats.

RUSSIA.—Armoured Ships.

(B.S., Black Sea Fleet.)

a.c., armoured cruiser; *a.g.b.*, armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.b.*, central-battery ship; *c.s.*, coast-service vessel; *t.*, turret ship; f. tu., l car., fixed tube or launching carriage for Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Turret or Battery.						Guns. B.L.R. are of Russian Krupp pattern.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	ins.	ft.	in.						£	knots.	tons.	knots.
t.	**Adm. Chichagoff** (iron)	3511	254	3	42	7	6	6	17½	18	9	1	2060	2 11-in. 28-ton B.L.R., 3 M., 4 l.	..	1868	..	10·00	300	—
„	**Adm. Greig** . (iron)	3593	252	7	42	7	4½	6	17½	20	11	1	2031	3 11-in. 28-ton B.L.R., 3 M., 4 l.	..	1868	..	10·00	300	—
„	**Adm. Lazareff** (iron)	3556	252	7	42	7	4½	6	17½	20	4	1	2004	3 11-in. 28-ton B.L.R., 4 l. . .	..	1867	..	10·00	300	—
a.c.	**Admiral Nachimoff** (²) (steel and iron and wood sheathed) . . .	7782	330	0	61	0	10	12	..	25	9	2	9000	4 9-in. 9-ton B.L.R., 10 6-in. 4-ton do., 6 M., 4 l.	4 f. tu. or l.car	1885	..	17·50	950	—
t.	**Adm. Spiridoff** (iron)	3740	254	3	42	7	6	6	17½	19	1	1	2007	2 11-in. 28-ton B.L.R., 3 M., 4 l.	..	1868	..	10·00	300	—
b.	**Alexander II.** (²) (steel and wood sheathed)	8440	326	0	67	0	14	10 barbette	3-in. steel dk.	23	0	2	8500	2 12-in. B.L.R., 4 9-in. do., 8 6-in. do., 4 Q.F., 6 M., 4 l.	4 f. tu. or l.car	1887	..	16·00	—	—
„	**Alexander Nevsky** (steel)	7572	331	0	62	6	10	12 barbette	do.	..		2	..	2 8-in. B.L.R., 14 6-in. 4-ton do.	..	Bldg.	..	16·00	—	—
c.s., t.	**Bronenosetz** . (iron)	1482	200	0	45	11	5 1-in. plates	11 1-in. plates	..	12	2	1	481	2 9-in. 15-ton B.L.R. . .	..	1864	..	7·00	—	—
b.	**Catherine II.** (¹) B.S. (iron and steel and sheathed with wood) .	10,150	313	4	69	0	16	14 barbette	..	26	0	2	11,000	6 12-in. (50-ton) B.L.R., 7 6-in. 4-ton do., 7 M.	7 f. tu. or l.car	1886 and is now complete.	900,000	16·00	886	1350 at 14 knots
c.s., t.	**Czarodeika** . (iron)	2026	206	9	42	7	4½	6 turret	17½	12	2	2	786	4 9-in. 15-ton B.L.R., 1 M. .	..	1867	..	8·00	250	—
a.c.	**Dimitri Donskoi** (iron and steel wood sheathed)	5893	296	5	52	0	6	unarmoured	..	24	4	2	7000	2 8-in. 9-ton B.L.R., 14 6-in. 4-ton do., 10 M., 4 l.	4 f. tu. or l.car	1883	..	15·50	..	4800
c.s., t.	**Edinorog** . (iron)	1407	200	0	45	11	5 1-in. plates	11 1-in. plates	39	..		1	460	2 9-in. 15-ton B.L.R. . .	..	1864	..	6·00	—	—
a.c.	**Emperor Nikolas** (²) . (steel and wood sheathed)	8440	326	0	67	0	14	10-inch	3-in. steel dk.	..		2	8500	2 12-in. B.L.R. 4 9-in. do., 8 6-in. do., 4 Q.F., 6 M., 4 l.	4 f. tu. or l.car	bldg. at	S. Petersb'rg	16·00	—	—
„	**General Admiral** (iron and wood)	4604	285	5	49	3	6	unarmoured	9¾	22	11	1	4472	6 8-in. 9-ton B.L.R., 2 6-in. do., 7 M., 5 l.	2 f. tu. or l.car	1873	..	12·00	1000	—
„	**Herzog Edinburgski** (iron and wood)	4604	285	5	49	3	6	unarmoured	9¾	22	11	1	5222	4 8-in. 9-ton 6 6-in. 4-ton B.L.R., 2 M., 6 l.	2 f. tu. or l.car	1875	..	12·50	1000	—
c.b.	**Kniaz Pojarski** (iron)	5007	272	4	49	3	4½—3½	4½	..	23	11	1	new machinery	8 8-in. 9-ton B.L.R., 2 6-in. 4-ton do., 4 M., 8 l.	..	1867	..	12·50	600	—

a.c.	**Ship not named** (Sachsen type)	9800	377	0	50	0	..	..	..	..		2	5000	.. ..	..	Just commenced at St. Petersburg.				
c.s., t.	**Koldun** . . .(iron)	1666	200	0	45	11	5 1-in. plates	11 1-in. plates	39	12	0	1	481	2 9-in. 15-ton B.L.R. . .	..	1864	..	6·00	—	—
br.	**Kreml** . . .(iron)	3664	219	10	52	5	4½	4½	17½	17	4	1	1121	14 8-in. 9-ton B.L.R., 2 M., 6 l.	..	1864	..	6·00	—	—
c.s., t.	**Latnik** . . .(iron)	1515	200	0	45	11	5 1-in. plates	11 1-in. plates	39	12	2	1	490	2 9-in. 15-ton B.L.R. . .	..	1864	..	6·00	—	—
„	**Lava** . . .(iron)	1591	200	0	45	11	5 1-in. plates	11 1-in. plates	39	12	0	1	335	2 9-in. 15-ton B.L.R., 2 M. .	..	1864	..	6·00	—	—
a.c.	**Minin** . . .(iron)	6168	298	6	49	3	7	unarmoured	..	25	3	1	5290	4 8-in. 9-ton B.L.R., 12 6-in. 4-ton do., 3 M., 4 l.	..	1878 altered	..	13·00	—	—
br.	**Netron-Menya** .(iron)	3494	219	10	53	0	4½	4½ battery	9¾	16	5	1	1632	12 8-in. 9-ton B.L.R., 2 M., 4 l.	..	1864	..	8·00	500	—
a.g.b.	**Nikopol,*** B.S.(iron & wood)	273	98	5	27	10	3	..	9¾	5	0	2	320	.. ..	..	1868	..	8·00	—	—
circular	**Novgorod,** B.S. (iron and wood)	2706	101	0	101	0	9—7 with Hughes' Backing.	9	†	13	5	6	2000	2 11-in. 29-ton B.L.R., 2 M., 2 l.	..	1873	..	6·00	200	—
a.c.	**Pamjatj Azova** (steel)	6000	355	0	50	0	10	8	..	..		1	8500	2 8-in 9-ton B.L.R., 4 6 in. 4-ton do.	..	Bldg.	..	17·00	—	—
c.s., t.	**Perun** . . .(iron)	1549	200	0	45	11	5 1-in. plates	11 1-in. plates	..	12	2	1	338	2 9-in. 15-ton B.L.R. . .	..	1864	..	6·00	—	—
t.	**Peter the Great** .(iron)	8749	328	2	62	4	14—8	8+6 turret	9¾	23	0	2	8258	4 12-in. 40-ton B.L.R., 4 M., 4 l.	1 f. tu. or l. car	1872	..	13·00	1200	—
br.	**Petropaulowski**‡ (wood)	6240	294	0	56	0	4½	4½	..	24	0	1	2800	21 8-in. 9 ton B.L.R., 1 6-in do.	..	1865	..	11·00	—	—
„	**Pervenets** . .(iron)	3279	219	10	52	5	4½	4½	9¾	14	9	1	1067	1 9-in. M.L.R., 10 8-in. 9-ton B.L.R., 2 6-in. 4-ton do., 9 M., 4 l.	..	1863	..	9·00	—	—
c.s., t.	**Rusalka** . . .(iron)	2026	206	9	42	7	4½	6 turret	17½	12	9	2	786	4 9-in. 15-ton B.L.R., 2 M. .	..	1867	..	8·00	250	—
br.	**Sevastopol**‡ . (wood)	6210	295	0	52	0	4½	4½	..	25	6	1	3090	10 8-in. 9 ton. B.L.R. . .	..	1863	..	12·00	—	—
b.	**Sinopé,** B.S. (¹) (iron & steel and sheathed with wood)	10,150	313	11	69	0	16	14 barbette	..	26	0	2	13000	6 12-in. 50-ton B.L.R., 7 6-in. 4-ton do., 7 M.	7 f. tu. or l. car	1887	900,000	16·75	886	1350 a 14 kts
a.g.b.	**Sistovo,** B.S. . .(iron)	384	105	0	30	10	3	..	9¾	5	11	2	250	.. ..	..	1868	..	8·00	—	—
c.s., t.	**Smertz** . . .(iron)	1520	187	0	39	4	4½	6 turret	7¾	11	6	2	700	2 9-in. 15-ton B.L.R., 1 M. .	..	1864	..	8·00	250	—
„	**Strelets** . . .(iron)	1431	200	0	45	11	5 1-in. plates	11 1-in. plates	39	11	6	1	444	2 9-in. 15-ton B.L.R. . .	..	1864	..	6·00	—	—
b.	**Tchesmé,** B.S. (¹) (iron & steel & sheathed with wood)	10,150	313	11	69	0	16	14 barbette	..	26	0	2	11000	6 12-in. (50 ton) B.L.R., 7 6-in. 4-ton do., 7 M.	7 f. tu. or l. car	1886 and is not completed	900,000	16·00	886	1350 at 14 kts
c.s., t.	**Tifun** . . .(iron)	1666	200	0	45	11	5 1-in. plates	11 1-in. plates	39	12	5	1	453	2 9-in. 15-ton B.L.R., 1 M. .	..	1864	..	6·00	—	—
„	**Uragan** . . .(iron)	1415	200	0	45	11	5 1-in. plates	11 1-in. plates	39	11	6	1	432	2 9-in 15-ton B.L.R. . .	..	1864	..	6·00	—	—
circular	**Vice-Admiral Popoff,** B.S. (iron & wood)	3590	120	0	120	0	16	16 tower	9	13	5	6	3066	2 12-in. 40-ton B.L.R., 6 l. .	..	1875	..	6·00	250	—
c.s., t.	**Veshtchun** . .(iron)	1448	200	0	45	11	5 1-in. plates	11 1-in. plates	39	11	6	1	529	2 9-in. 15-ton B.L.R. . .	..	1864	..	6·00	—	—
a.c	**Vladimir Monomach** (steel, iron & wood)	5796	296	6	52	0	6 comp.	unarmoured	..	24	11	2	7000	4 8-in. 9-ton B.L.R., 12 6-in 4-ton do., 4 M., 4 l.	2 f. tu. or l. car	1882	..	15·40	400	—

NOTES ON THE RUSSIAN NAVY.— ARMOURED SHIPS.

(1) CATHERINE II., TCHESMÉ, SINOPE.

Catherine II., Tchesmé, Sinope.

These ships of the Black Sea Fleet, which are alike in design, were partially described in *The Naval Annual* for 1886, at page 264. The first two were laid down late in 1883, and were launched in May 1886. The Sinope was laid down in April 1884, and was launched in June 1887.

They are built of iron and steel, and are sheathed with wood and coppered. Their dimensions, displacement, and horse-power of engines are given on the alphabetical lists.

The armament consists of six 12-inch B.L.R. guns, mounted in pairs in barbette in a large central pear-shaped citadel, on Moncrieff disappearing mountings; six 6-inch B.L.R. guns on the broadside on the gun deck, and one 6-inch B.L. aft on the same deck, and seven machine-guns. She has also seven fish torpedo dischargers.

The armour protection, which was manufactured by Cammell of Sheffield, consists of a complete belt of compound armour, 16-in. thick, and a complete steel deck 3-in. thick. The armour on the citadel is 14-in. thick.

The engines of the Catherine II., which are of the compound three-cylinder vertical type, were built at the Baltic Works, at St. Petersburg, and are intended to develop 11,000 horse-power and to give the ship a speed of 16 knots. The engines of the Tchesmé of the same type were built by Cockerill, in Belgium. Those of the Sinope are of triple expansion type and will probably develop under forced draught 13,000 horse-power. They were built by Napier, of Glasgow. The entire cost will be about £900,000 for each vessel.

(2) ALEXANDER II. AND EMPEROR NICHOLAS.

Alexander II. and Emperor Nicholas.

The Alexander II. (briefly described on page 264 of *The Naval Annual* for 1886), and the Emperor Nicholas are of the same type and dimensions. The former was laid down in November 1885, at the Admiralty Works, St. Petersburg, and launched in July 1887. The second was laid down in July 1886, at the works of the Franco-Russian Company, at St. Petersburg. Their dimensions, displacement, and horse-power of engines are given in the alphabetical list of armoured ships. They are built of iron and steel, sheathed with

Alexander II. and Emperor Nicholas.

wood and coppered. They are brig-rigged, and will have a complement of men and officers of 570. The armour protection consists of a complete belt 9-ft. wide, of a maximum thickness of 14-in., a pear-shaped barbette forward covered with 10-in. armour, and a complete curved steel deck 3-in. thick.

The armament is to consist of two 12-in. B.R.L. guns in the barbette, four 9-in. B.L.R. guns, eight 6-in. guns, and four 3½-in. guns of the same description, 4 Q.F. guns, and 6 machine-guns.

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(3) ADMIRAL NACHIMOFF.

The Admiral Nachimoff

A Russian ironclad, modelled on the Impérieuse, arrived at Cronstadt, at Midsummer 1887, from the Baltic Engineering Works, at St. Petersburg, to receive her artillery, &c., aboard, preparatory to being attached to the Baltic Fleet. The Admiral Nachimoff is 330-ft. long (the Impérieuse is 315 ft.), 61-ft. broad (the Impérieuse is 62 ft.) and has a displacement of 7782 tons as compared with the 7600 tons of the English vessel, as designed. The contract for the ironclad was signed in July 1884, and the launch took place in October the following year. Last October the official trials took place, when the engines (two triple-expansion engines of 4000 indicated horse-power each) worked up to 4500 horse-power, and realised a speed of 17½ knots. The hull of the Nachimoff is built entirely of Russian metal, the steel being manufactured at the Putiloff Works, at St. Petersburg. The armour-plating, which ranges in thickness from 6-in. to 12-in., was rolled at the Kolpina Steel Works, where Messrs. Cammell and Co. have established an armour rolling-mill for the Russian Government. Without armour and fittings the hull has cost £262,000; the engines, without auxiliary mechanism, £128,000. The pumps are of the Gwynne description, and the fire-engines are being supplied by Messrs. Shand and Mason. The two torpedo cutters, which the ironclad carries, have been built by Messrs. Crichton and Co., of Abo-Finland. The machine-guns used are of the Hotchkiss description, and the vessel is fitted with a tube and launching carriages for discharging 15-ft. Whitehead torpedoes.

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RUSSIA.—Unarmoured Ships.

(Bal., Baltic Fleet; B.S., Black Sea Fleet; Sib., Siberian Squadron.)
corv., corvette; *cr.*, cruiser; *d.v.*, despatch vessel; *g.v.*, gun-vessel; *to.cr.*, torpedo cruiser; *sl.*, sloop; P, deck protected throughout;
f. tu., l. car., fixed tube or launching carriage for Fish torpedoes.

On the Russian List are the names of a large number of vessels which cannot be classified on the principles adopted in the British Navy. Many, though used for practically civil purposes, would be available for service of some kind in war. In the following Table steamers, with guns, of over 300 tons are included, and are designated despatch vessels (*d.v.*), or gun-vessels (*g.v.*). Other vessels are placed in the summaries after the Table.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
									Guns.	Fish Torpedo Dischargers					
		tons.	ft. in	ft. in.		ft. in.						£	knots.	tons.	knots.
sl.	**Abrek**, Sib.	1069	193 6	29 6	wood	13 1	1	1109	3 6-in. B.L.R., 1 M., 2 l.	..	1860	—	—	—	—
cr.	**Admiral Korniloff**, Bal. P. (¹)	5000	350 0	48 6	steel & wood	..	2	8260	14 16-c.m. B.L.R., 6 Q.F., 10 M.	f. tu. or l.car	1887	..	19·00	—	—
corv.	**Afrika**, Bal.	2852	285 5	39 4	iron	17 1	1	1350	5 6-in. 4-ton B.L.R., 4 M., 7 l.	..	1877	..	13·00	—	—
cr.	**Aleut**, Bal.	810	170 0	31 0	steel	10 0	1	1300	.. ..	..	1886	—	—	—	—
„	**Asia**, Bal.	2483	269 0	36 0	iron	16 5	1	1100	8 6-in. 4-ton B.L.R., 6 M., 5 l.	..	1878	..	12·00	—	—
„	**Askold**, Bal.	2245	216 6	39 4	wood	20 4	1	910	8 6-in. 4-ton B.L.R., 5 M., 5 l.	..	1863	..	9·00	—	—
„	**Bayan**, Bal.	1998	206 9	36 0	„	18 4	1	978	4 6-in. 4-ton B.L.R., 2 M., 5 l.	..	1857	..	9·00	—	—
g.v.	**Bobr**, Sib.	950	187 0	35 2	steel	10 10	2	1000	1 24-c.m. 15-ton B.L.R., 1 15-c.m. 4-ton do., 2 M., 6 l.	..	1884	43,000	14·00	—	—
corv.	**Bogatyr**, Bal.	2204	213 3	39 4	wood	19 4	1	991	8 6-in. 4-ton B.L.R., 1 M., 4 l.	..	1860	—	9·00	—	—
g.v.	**Bombory**, B.S.	760	160 9	26 8	„	14 5	1	230	2 small guns	..	1852	—	—	—	—
to.cr.	**Captain Sacken**, B.S. (⁴)	600	230 0	24 0	steel	8 10	2	3500	.. ..	..	1887	..	20·00	—	—
g.v.	**Chernomorets**, B.S. (³)	1200	210 0	35 0	..	10 0	1	2000	2 8-in. B.L.R., 1 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	1887	—	—	—	—
g.v.	**Coreets**, Sib., (³)	1200	210 0	35 0	..	10 0	1	2000	2 8-in. B.L.R., 1 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	1886	—	—	—	—
corv.	**Djigit**, Bal.	1456	206 9	32 10	iron & wood	16 1	1	1383	3 6-in. 4-ton B.L.R., 4 M., 4 l.	..	1876	..	12·50	—	—
g.v.	**Don**, B.S.	354	131 3	26 0	steel & wood sheathed	10 2	1	80 (nom.)	2 small guns	..	1856	—	—	—	—
„	**Donets**, B.S. (³)	1200	210 0	35 0	..	10 0	1	2000	2 8-in. B.L.R., 1 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	1887	—	—	—	—
„	**Gones**, B.S. (Torpedo school)	715	173 10	20 0	iron	12 5	1	160 (nom.)	2 small guns		—	—	—	—	—

g.v.	**Gornostai, Sib.**	456	147	7	22	11	wood	8	3	1	150	6 guns	..	1863	—	—	—	—
to.cr.	**Ilyen, Bal.** (⁴)	600	230	0	24	0	steel	8	10	2	3500	1 Q.F.G., 12 M.	8 f. tu. or l.car	1887	..	20·10	97	—
g.v.	**Ingul, B.S.**	745	173	10	32	10	iron	12	5	1	469	2 guns	..	1872	—	—	—	—
d.v.	**Japonec, Sib.**	1472	200	2	36	0	wood	12	8	1	300 (nom.)	.. ..	..	1858	..	6·00	—	—
g.v.	**Jermak, Sib.**	706	154	3	26	3	iron	11	2	1	125	2 guns	..	1870	—	—	—	—
„	**Kasbeck, B.S.**	692	167	4	26	3	„	11	2	1	280	2 small guns	..	1854	—	—	—	—
„	**Kelasurz, B.S.**	307	121	4	19	7	wood	10	5	1	246	4 small guns	..	1859	—	—	—	—
corv.	**Kreyzer, Bal.**	1542	206	9	32	10	iron & wood	16	1	1	1205	3 6-in. 4-ton B.L.R., 1 M., 4 l.	..	1875	..	13·00	—	—
g.v.	**Kubanetz, B.S.** (³)	1200	210	0	35	0	..	10	0	1	2000	2 8-in. B.L.R., 1 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	Bldg. at Odessa.	—	—	—	—
„	**Manchooria, Bal.** (³)	1200	210	0	35	0	..	10	0	1	2000	2 8-in. B.L.R., 1 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	1886	—	—	—	—
cr.	**Maudsur, Bal.**	1224	210	0	36	0	iron & wood	10	0	1	1300	2 8-in. B.L.G., 1 6-in. do., 6 M.	..	Bldg.	..	13·00	—	—
g.v.	**Morz, Sib.**	456	147	7	22	11	wood	8	3	1	150	7 guns	..	1860	—	—	—	—
corv.	**Nayezdnik, Bal.**	1334	206	9	32	10	composite	14	9	1	1719	3 6-in. 4-ton B.L.R., 5 M., 4 l.	..	1878	..	13·00	—	—
g.v.	**Nerpa, Sib**	379	124	7	22	11	wood	7	10	1	60 (nom.)	5 guns	..	1860	—	—	—	—
corv.	**Oprichnik, Bal.**	1426	206	9	32	10	composite	16	0	1	1685	4 6-in. 4-ton B.L.R., 6 M., 2 l.	..	1880	..	13·00	—	—
cr.	**Pamyat Merkuriya, B.S.**	3050	292	0	39	4	iron & steel	19	7	1	800	6 6-in. B.L.R., 4 4-in. do.	..	1880	—	—	—	—
d.v.	**Penderaklia, B.S.**	1052	190	3	29	6	iron	12	8	1	568	3 guns	..	1877	—	—	—	—
g.v.	**Pitsunda, B.S.**	335	127	11	19	7	wood	9	7	1	572	3 small guns	..	1857	—	—	—	—
sl.	**Plastun, Bal.**	1255	206	9	32	10	composite	14	1	1	1543	3 6-in. 4-ton B.L.R., 4 M., 5 l.	..	1879	..	12·00	—	—
g.v.	**Prut, B.S.**	339	154	3	23	0	iron	7	3	1	327	2 guns	..	1849	—	—	—	—
„	**Psezuappe, B.S.**	335	127	11	19	7	„	10	5	1	216	4 small guns	..	1857	—	—	—	—
corv.	**Razbonyik, Bal.**	1329	206	9	32	10	iron & wood	14	9	1	1786	3 6-in. 4-ton B.L.R., 5 M., 4 l.	..	1878	125,000	12·00	—	—
cr.	**Rynda, Bal. P.** (³)	2950	265	9	45	11	steel & wood sheathed.	16	1	2	3600	10 6-in. 4-ton B.L.R., 6 M., 4 l.	2 f. tu. or l.car	1885	..	15·00	710	2400
g.v.	**Salgir, B.S.**	360	131	3	23	0	wood	10	5	1	107	.. ..	..	1857	—	—	—	—
„	**Sivuz, Sib.**	950	187	0	33	2	steel	10	10	2	1000	1 24-c.m. 15-ton B.L.R., 1 15-c.m. 4-ton do., 2 M., 6 l.	..	1884	43,000	14·00	—	—
corv.	**Skobeleff, Bal.**	2397	216	6	39	4	wood	19	0	1	1042	8 6-in. 4-ton B.L.R., 4 M., 4 l.	..	1862	..	9·00	—	—
g.v.	**Sobol, Sib.**	456	147	7	22	11	„	8	3	1	150	6 guns	..	1863	—	—	—	—
sl.	**Sokol, B.S.**	1057	160	9	32	10	„	15	5	1	346	1 6-in. 4-ton B.L.R., 1 M., 8 l.	..	1859	—	—	—	—

RUSSIA.—Unarmoured Ships—*continued.*

(Bal., Baltic Fleet; B.S., Black Sea Fleet; Sib., Siberian Squadron.)

corv., corvette; *cr.*, cruiser; *d.v.*, despatch vessel; *g.v.*, gun-vessel; *sl.*, sloop; *t. b. c.*, torpedo boat-catcher; P, deck protected throughout; f. tu., l. car., fixed tube or launching carriage for discharging Fish Torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
g.v.	**Souk-Su,** B.S.	307	121	4	19	8	wood	10	5	1	317	3 guns	..	1859	—	—	—	—
corv.	**Strjelok,** Bal.	1343	206	9	32	10	composite	14	2	1	1528	3 6-in. 4-ton B.L.R., 4 M., 4 l.	..	1879	..	13·00	—	—
fr.cr.	**Swjetlana,** Bal.	3200	223	2	49	3	wood	22	4	1	1113	6 8-in. 9-ton B.L.R., 6 6-in. 4-ton do., 7 M., 5 l.	..	1858	..	10·00	—	—
g.v.	**Tamanj,** B.S.	551	173	10	25	11	iron	9	7	1	745	2 guns	..	1849	—	—	—	—
,,	**Terets,** B.S. (3)	1200	210	0	35	0	..	10	0	..	2000	2 8-in. B.L.R., 1 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	Bldg.	—	—	—	—
,,	**Tunguz,** Sib.	706	154	3	26	3	,,	11	2	1	130	4 guns	..	1870	—	—	—	—
,,	**Turok,** B.S.	537	134	6	24	11	wood	11	2	1	422	2 guns	..	1846	—	—	—	—
,,	**Uraletz,** B.S. (3)	1200	210	0	35	0	..	10	0	..	2000	2 8-in. B.L.R., 1 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	Bldg.	—	—	—	—
cr.	**Vitiaz,** Bal. P.	2950	265	9	45	11	steel & wood sheathed.	16	1	2	3000	8 6-in. 4-ton B.L.R., 6 M., 4 l.	2 f. tu. or l.car	1884	125,000	15·00	710	2400
sl.	**Vjestnik,** Bal.	1255	206	9	32	10	iron & wood sheathed.	14	2	1	1268	3 6-in. 4-ton B.L.R., 4 M., 4 l.	..	1879	..	11·00	—	—
corv.	**Vojin,** B.S.	1652	183	9	39	4	wood	17	4	1	875	1 8-in. B.L.R., 5 6-in. do., 3 M., 4 l.	..	1858	—	—	—	—
Tor. vessel.	**Vzriw**	134	118	2	16	1	iron & wood.	10	10	1	800	.. ..	..	1877	..	17·00	—	—
sl.	**Zabiyaka,** Bal.	1234	219	10	29	6	iron	14	9	1	1470	2 6-in. 4-ton B.L.R., 4 M., 5 l.	..	1878	..	14·00	—	—
g.v.	**Zaporogets,** B.S. (3)	1200	210	0	35	0	..	10	0	..	1500	2 8-in. B.L.R., 11 6-in. do., 2 Q.F., 4 M.	2 f. tu. or l.car	1887	—	—	—	—
corv.	**Zemzug,** Bal.	1781	239	6	29	6	iron	17	4	1	1438	3 6-in. 4-ton B.L.R., 4 M., 4 l.	2 f. tu. or l.car	1861	—	—	—	—

Two corvettes, Varyag and Vevoda; one cruiser, Europa; two gun-vessels, Gaidamak and Izoovod, and two gun boats, Kartesh and Otliv, are used for Harbour Service only.

Gunboats, Staunch class (*Baltic Fleet*).—Burja, Burun, Dozd, Grad, Groza, Jorz, Mina, Snjeg, Turza, Wichr, Yersh (258 to 402 tons, 195 to 472 I.H.P.).

Gunboats (*Baltic Fleet*).—Korsun, 191 tons, and Szit, 240 tons. Also two building. Seven "steamers" building.

Steamers (*Gun vessels, Despatch vessels, &c.*) (*Black Sea Fleet*).—Abin, Ablanova, Batjuska, Bogot, Boltun, Bratec, Brestovitz, Matuska, Rodimyi, Sestrica, Tuabse (90 to 298 tons).

Steamer (*Siberian Squadron*).—Amur (190 tons).

Also yachts, training ships, paddle steamers, and the Caspian and Lake Aral Flotillas of small vessels. Among the yachts is the circular ship Opit, formerly the Livadia.

Torpedo boats (*Baltic Fleet*)—built and building—ten over 100 feet in length, viz., eight of the Sweaborg class and two of the Wiborg class; seventy-four over 70 feet and under 100 feet, twenty under 70 feet, twenty-one not carrying Whitehead torpedoes.

Torpedo boats (*Black Sea Fleet*)—built and building—twelve over 100 feet in length, mainly of the Batoum type, five between 70 feet and 100 feet, sixteen under 70 feet in length, three not carrying Whitehead torpedoes.

Torpedo boats (*Siberian Squadron*).—Six under 70 feet in length.

VOLUNTEER FLEET IN THE BLACK SEA.

Class.	NAME.	Material built of.	Where built.	When built.	Length.		Breadth.		Depth of Water.		Displacement.	Horse-power of Engines.	No. of Screws.	
					ft.	in.	ft.	in.	ft.	in.	tons.			
Auxiliary Cruiser	**Czar**	steel	Newcastle	1883	319	0	37	0	23	6	2240	350 nom.	1	These vessels, which have a speed of 16 knots, carry five to ten 12-c.m. B.L. guns, and several machine-guns.
"	**Czarevna**	"	"	1883	319	0	37	0	23	6	2240	350 nom.	1	
"	**Czaritza**	"	"	1883	319	0	37	0	23	6	2240	350 nom.	1	
Cruiser	**Kostroma**	iron	Glasgow	1873	372	0	36	0	..		3030	—	—	
"	**Moskwa** (was Kinfauns Castle)	"	"	1879	360	0	43	0	..		3050	2730	1	
"	**Nijni Novgorod** (was Saxonia)	"	Greenock	1857	321	0	40	0	..		2670	300 nom.	1	
"	**St. Petersburg** (was Thuringia)	"	"	1870	340	0	41	0	..		3050	2600	1	
"	**Russia** (was Holsatia)	"	"	1868	341	0	40	0	21	0	3100	2200	1	
"	**Vladivostock**	"	Renfrew	1880	324	0	29	0	..		1200	..	1	
"	**Yaroslav**	"	La Seyne	1880	295	0	41	0	..		2350	3000	1	
"	**Argonaut**	—	—	—	—		—		—		—	—	—	
	Constantine	—	—	—	—		—		—		—	—	—	
"	**Vesta**	—	—	—	—		—		—		—	—	—	

wood
iron
29 6
0 35
corv. ~~[illegible]~~ 1781 239

NOTES ON THE RUSSIAN NAVY.—UNARMOURED SHIPS.

(1) Admiral Korniloff.

Admiral Korniloff.

This large protected twin-screw steel cruiser for the Russian Government was laid down at St. Nazaire in the latter part of the year 1885, and was launched on 9th of April, 1887. She is built of steel, and sheathed with wood and coppered.

She has a curved steel deck protecting the engines, boilers, &c., of a thickness of 2⅜ in., and between this deck and that above, the space is, as usual in such ships, divided into a large number of water-tight compartments, and the several hatchways are protected by coffer-dams. The dimensions, displacement and horse-power of the triple expansive engines are given in the alphabetical list of unarmoured ships. The expected speed is 19 knots.

The armament is fourteen 16-centimetre B.L. guns, four of which are mounted on sponsons giving bow and stern fire; six quick-firing guns and ten machine guns. She has also several fish torpedo dischargers.

(2) Rynda Class.

Rynda Class.

It is stated that orders have been given for the construction of six more ships of this class, which are described in the alphabetical list of unarmoured vessels, and in *The Naval Annual* for 1886, at p. 270.

(3) Coreetz, Manchooria.

Coreetz, Manchooria.

These small twin-screw cruisers, 210 ft. long, 35 ft. broad, 10 ft. draught of water, and displacement of 1200 tons, were launched at the end of the year 1886; the former at Stockholm, and the latter at Copenhagen. They are now completed.

The horse-power of the engines is expected to be 2000.

The armament is two 8-inch B.L. guns, one 6-inch diameter, two 6-pounder quick-firing guns, four machine guns, and two fish torpedo dischargers.

Three others of the same type, dimensions and speed, viz. Uraletz, Teretz, and Kubanetz (referred to on p. 269 of *The Naval Annual* for 1886), were laid down at Sebastopol in 1886, and their machinery is being manufactured at the Motala Works, Sweden.

Three others of the same type, size and speed—Zaporojetz, Donetz, Coreetz, Manchooria.

Chernomoretz—(also referred to in the *The Naval Annual* for 1886), were laid down at Nicolaieff in 1886, and with the three others are now on the point of completion. The machinery for the last three is being manufactured by Napier, of Glasgow.

(4) ILYEN.

Ilyen.

This vessel, which was laid down at the Baltic Works in December 1885, has a complete steel deck. The dimensions are given in the alphabetical list of unarmoured vessels. She was originally intended to have a single screw. After experiments made with a torpedo boat it was decided to fit the vessel with twin screws. The engines are triple expansions, designed by Napier, of Glasgow, but manufactured at the Baltic Works. There are four boilers, two of them being of the locomotive type. The supply of coal is 97 tons, and the complement of men and officers 109.

Captain Sacken.

On trial, the horse-power developed was 3550, and the speed of the vessel 19·67 knots. On a later trial a speed of 20·1 knots was reached. The Captain Sacken is a sister vessel to Ilyen, and was laid down at Nicolaieff in 1886, as mentioned in *The Naval Annual* for that year.

WIBORG.

Wiborg.

This vessel, which was built by Messrs. J. and G. Thomson, of Glasgow, is 148 ft. long over all, 17 ft. beam, and 9 ft. 6 in. depth at the middle. Her displacement with coals on board for 1200 knots steaming at 10 knots per hour, with stores and equipment for twenty-four men, and with her armament and outfit complete for a fifteen days' cruise, is 125 tons, but as the bunker capacity is sufficient for 3600 knots, steaming at 10 knots, she will generally leave port at a displacement of 160 tons. Her general arrangement of torpedo armament forward is not very different from that of the smaller torpedo boats. She has two 19-ft. tubes in the bow, but she has in addition a 19-ft. broadside tube on the deck. Her gun armament consists of two 37-mm. Hotchkiss revolving cannon placed forward abreast of the funnels. The magazine of this vessel is directly under the guns, but is well protected by being below the water-line. The conning tower is thickly plated on the front, and the chain locker on the deck immediately in front of it aids considerably in the protection of the telegraphs, steering gear, and voice pipes contained in it. The forward part of the deck in wake of the torpedo tubes is covered with thick plating to protect the tubes and the men working at them. The machinery and boilers have coal bunkers completely surrounding them, thereby affording a double skin and a protection from gun-fire. The boilers are in two separate compartments. With one boiler damaged the vessel will travel at 17½ knots, or with one engine damaged at about 17 knots. The engine-room contains, including the main engines, thirteen distinct sets of machinery. Steam starting gear is fitted for facility in handling the engines. The vessel is fitted with thirty incandescent lights, and a search light of 12,000 candles. The masthead and side lights are electric. **Wiborg.**

The vessel is divided into twenty-two water-tight compartments. In the crew space, for about 3 ft. in the vicinity of the water-line the vessel has a double side, divided longitudinally into small compartments each about 3 ft. long. The total pumping power in this ship is 2000 tons per hour, so that she can pump out a quantity of water equal to her own displacement, in four minutes. The vessel is fitted with a bow rudder, which adds to her turning capability.

SARAWAK.

Gunboat.—Aline: length, 142 ft. 6 in.; beam, 21 ft. 3 in.; tonnage, 175; 35 nom. H.P.; 2 guns; launched 1875. Lorna Doone; length, 103 ft. 4 in.; beam, 17 ft. 2 in.; tonnage, 118; 40 nom. H.P.; 2 guns; launched 1881.

Paddle steamer, Aden. Three armed launches (50 to 100 tons).

SIAM.—Unarmoured Ships.

Two corvettes (1000 tons, 8 guns); three gun-vessels; two gunboats; yachts, and small craft.

SPAIN.—Armoured Ships.

a.g.b., armoured gunboat; *b.*, barbette ship; *br.*, broadside ship; *c.s.*, coast-service vessel; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for Fish torpedoes.

Class.	NAME.	Displacement.	Length.	Beam.	Armour.		Backing.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
					Belt.	Battery.					Guns.	Fish Torpedo Dis-chargers					
		tons.	ft. in.	ft. in.	inches.	inches.	inches.	ft. in.						£	knots.	tons.	knots.
b.	(¹) **Pelayo** (completing in France)	9900	330 0	66 0	17¾	19¼ bar-bettes	..	24 11	2	8000	2 32-c.m. 48-ton B.L.R., 2 28-c.m. 38-ton B.L.R., 1 16-c.m. do., 12 12-c.m. do., 14 M.,	7 f. tu. or l.car	1887	..	16·00	700	—
a.g.b.	**Duque de Tetuan** (iron)	703	141 0	31 2	4	4	9	6 10	2	190	1 16-c.m. (Parrot), 4 bronze smooth-bores.	..	1874	..	..	23	—
br.	**Mendez Nunez** (wood)	3382	236 3	49 3	5	4½	20	21 11	1	500 (nom.)	4 9-in. 13-ton M.L.R. (Armstrong), 2 8-in. do.	..	1861	..	8·00	400	—
„	**Numancia** (iron)	7305	314 10	55 9	5½	5	12	25 3	1	3708	8 10-in. M.L.R. (Armstrong), 7 8-in. do., 2 M., 8 l.	..	1863	315,600	8·00	740	2450
c.s., t.	**Puig-cerda** (iron Monitor)	553	127 11	29 6	4	4	9	6 7	2	328	2 16-c.m. bronze smoothbores, 1 16-c.m. B.L.R. (Palliser).	..	1874	..	8·00	23	—
br.	**Sagunto** . (wood)	7352	292 0	55 10	6	6	24	30 1	1	3700	8 9-in. 13-ton M.L.R. (Armstrong), 3 18-c.m. (Palliser), 2 M., 8 l.	..	1869	..	8·00	900	—
„	**Vitoria** . (iron)	7250	318 3	55 10	5¼	5	12	25 3	1	4500	8 9-in. 13-ton M.L.R. (Armstrong), 3 8-in. do., 2 M., 6 l.	2 f. tu. or l.car	1865	..	11·00	900	—
„	**Zaragoza** . (wood).	5620	278 10	55 10	5	5	26	24 7	1	3000	4 9-in. 13-ton M.L.R. (Armstrong), 3 18-c.m. (Palliser), 8 16-c.m. do., 2 M., 7 l.	..	1867	..	8·00	700	—

NOTES ON THE SPANISH NAVY.—ARMOURED SHIPS.

(1) Pelayo.

The Pelayo.

The ironclad Pelayo, launched in 1887, has been built at La Seyne for the Spanish Government, upon plans that have been furnished by the builders. The contract for this ship was signed in November 1884, and the stipulated date for her completion is January 1888, when she is to be handed over to the Spanish Admiralty, completely fitted, and ready for active service. The builders contracted to furnish not only the vessel complete with engines, masting, and all the auxiliary machinery and plant, but also the gun carriages, platforms, and hydraulic machinery for the working of the large guns, which will be mounted on the four barbette towers on the upper deck, and the plant for electric lighting, including projectors for search lights. The heavy guns will also probably be made by them at their Havre factory.

The principal dimensions of the Pelayo are:—Length, 330 ft.; greatest beam outside armour at the water-line, 66 ft.; draught, 24 ft. 11 in.; displacement, 9900 tons. With forced draught the engines are intended to indicate over 8000 horse-power, and the speed obtained should then reach 16 knots.

The Pelayo is built wholly of steel. The hull is constructed upon the cellular system, and is protected by an armoured deck situated above the load water-line, where a belt of armour plating extends from end to end of the vessel. Above its protected portion, the hull is of slight construction.

A double bottom extends along the greater length of the ship, and is divided into 98 water-tight compartments. The hull above this double cellular bottom is again divided in compartments by 16 transverse bulkheads; while the engine-room, stokeholds, and the central magazine are divided by a longitudinal central water-tight bulkhead, which rises from the inner skin to the underside of the armoured deck. All these compartments, as well as those of the double bottom, are in connection with a collecting pipe 11·8 in. in diameter, which extends from bow to stern, and serves as the suction for two centrifugal pumps, each of which can discharge 500 tons of water per hour. The coal bunkers, which hold about 700 tons, are placed on each side

The Pelayo.

of the stokehold to afford additional protection. The powder and shell magazines are arranged in three groups near the turrets that they serve. They are fitted with very complete plant for handling the ammunition, which is lifted direct to the guns.

There are twelve boilers, placed in four stokeholds, in pairs back to back. The grate surface is about 820 square feet, and the heating surface is nearly 23,300 square feet. Four fans supply air to the stokeholds when the maximum engine power is required. The main engines, which are placed near the boilers, in two independent groups, are of the vertical inverted type, and each drives one of the twin screws. Each group comprises two engines driving on to the same shaft. These engines are compound expansion, so that each group has four cylinders and two condensers. There are also, in each engine-room two auxiliary engines to work the circulating pump of the main engines, two starting engines, and two fan engines for ventilating the engine-room.

There are two other decks above the protected one, and the ships' side rises in consequence to a considerable height above the water. The upper deck is armed with a battery of 12-centimetre guns. In the battery and in the lower 'tween deck, quarters are provided for the admiral, the staff, the officers, the midshipmen, and engineers. There are also two very airy and spacious hospital wards.

The armament of the Pelayo is as follows:—Upon the upper deck are four barbette towers for the heavy guns. Two of these, armed with 32-centimetre guns, are placed one forward and the other aft. The two others, each armed with a 28-centimetre gun, are placed amidships, one on each side; three of these barbettes are so placed that the axis of the guns is 25 ft. 4 in. above the water-line. The forward barbette is still higher, being so raised above the hurricane deck as to lift the gun to a height of 28 ft. 10 in. above the water-line.

These four barbettes are provided with Canet gun carriages, slides, platforms, and hydraulic lifts. This arrangement adopted by the Spanish Government, which is similar to that on the French ironclad Marceau, allows the guns to be loaded in any position, thus avoiding the serious inconvenience of having to run them back to a special position in order to load.

The upper broadside battery comprises twelve 12-centimetre guns (Hontoria system), placed six on each side, and a 16-centimetre Hontoria gun is placed forward on the upper deck, directly under the hurricane deck. The armament also includes a large number of Hotchkiss 37-millimetre revolving guns and quick-firing 37-millimetre and 47-millimetre guns, placed on the deck, in the tops, and in various positions on the upper deck. The Pelayo will be fitted

The Pelayo

to receive seven torpedo dischargers (Schwartzkoff's system), placed upon the ironclad deck.

The armour plates are of steel and are made at Creusôt. In October last the first lot of plates passed proof successfully, the trial of a plate chosen by the Spanish commission being subjected to severe tests. The barbette towers and the ammunition tubes are protected by steel plates also made at the Creusôt Works. Some additional protection is furnished by the ironclad deck 3·94 in. thick, which extends the whole of the length, and which protects the vital parts; all openings in this deck are secured by iron hatches 11·81 in. thick and 39 in. high.

The Pelayo has two low military steel masts. These carry double tops armed with machine guns. The ship's rig is that of a fore and aft schooner, but the total sail area is insignificant.

SPAIN.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *t.b.c.*, torpedo boat-catcher; P, deck protected throughout; *pp.*, partial deck protected; f. tu., l. car., fixed tube or launching carriage for Fish torpedoes.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Fish Torpedo Dischargers	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
d.v.	**Africa**	629	157 5	23 3	wood	15 3	1	280	2 12-c.m. bronze smooth-bores . .	..	1862	..	7·00	120	—
cr.	**Alfonso XII.**	3090	278 10	42 7	steel	16 5	1	4800	8 16-c.m. B.L.R. (Hontoria), 4 9-c.m. do., 2 M., 2 l.	6 f. tu. or l.car	1887	..	17·50	600	—
cr.	**Alfonso XIII.** . . P.	5000	318 6	50 6	steel	20 0	2	11000	4 24-c.m. B.L.R., 6 12-c.m. do., 8 Q.F., 8 M.	5 f. tu. or l.car	Bldg.	..	20·00	—	—
fr.cr.	**Almanza** (Surveying ship) .	3960	275 7	49 3	wood	20 11	1	600 (nom.)	22 16-c.m. M.L.R. (Palliser), 2 M., 6 l. .	..	1864	..	7·00	650	—
g.v.	**Animosa** (for Colonial Guard ship)	510	150 11	26 3	iron	7 7	1	100 (nom.)	1 16-c.m. 6-ton M.L.R. (Palliser), 1 12-c.m. bronze smooth-bore, 2 l.	..	1860	..	8·00	—	—
cr.	**Aragon**	3342	246 0	45 11	wood	20 11	1	4400	8 16-c.m. B.L.R. (Hontoria), 2 8·7-c.m. do. (Krupp), 4 l., 2 M.	..	1879	..	14·00	470	—
g.v.	**Basan**	757	164 0	24 7	iron	10 10	2	739	1 13-c.m. M.L.R. (Parrot), 1 12-c.m. bronze, smooth-bore.	..	1873	..	10·00	—	—
fr.cr.	**Blanca** (for Colonial Guard ship)	2452	209 11	42 7	wood	18 4	1	360 (nom.)	12 20-c.m. smooth-bores, 4 16-c.m. do., 4 l.	..	1859	..	7·00	300	—
g.v.	**Caridad**	370	147 7	22 7	wood	10 5	1	80 (nom.)	2 16-c.m. bronze smooth-bores . .	..	1860	..	6·50	80	—
fr.cr.	**Cármen** (for Colonial Guard ship)	3116	242 9	45 11	wood	19 7	1	600 (nom.)	16 20-c.m. smooth-bores, 4 16-c.m. do., 4 l.	..	1861	..	8·00	460	—
cr.	**Castilla**	3342	246 0	45 11	wood	20 11	1	4400	8 15-c.m. B.L.R. (Krupp), 4 9-c.m. do. (Hontoria), 2 M., 2 l.	..	1881	..	14·00	470	—
g.v.	**Céres**	415	144 4	22 7	wood	8 6	1	80 (nom.)	2 16-c.m. smooth-bores	..	1860	..	6·00	80	—
"	**Concha**	524	157 5	25 7	iron	8 7	2	600	3 12-c.m. B.L.R. (Hontoria), 2 M. . .	2 f. tu. or l.car	Bldg.	..	11·50	80	—
fr.cr.	**Concepcion** (for Colonial Guard ship)	3210	220 7	45 11	wood	20 1	1	2100	5 16-c.m. M.L.R., 16 20-c.m. smooth-bores, 4 l.	..	1860	..	8·00	360	—

g.v.	**Concordia**		553	157	5	23	11	wood	10	6	1	160	2 16-c.m. smooth-bores.	..	1857	..	6·00	100	—
cr.	**Conde de Venadito**		1130	210	0	32	0	iron	12	6	1	1600	2 4¾-in. B.L.R., 2 3-½in. do., 5 M.	2 f. tu. or l.car	Bldg.	..	14·00	220	—
corv.	**Consuelo**		605	180	5	28	3	wood	9	10	1	353	2 16-c.m. M.L.R. (Parrot), 1 12-cm. bronze, smooth-bore, 2 l.	..	1858	..	8·00	180	—
cr.	**Cristobel Colon**		1130	210	0	32	0	iron	12	6	1	1600	3 6-in. B.L.R., 2 3½-in. do., 5 M.	2 f. tu. or l.car	1887		14·00	220	—
„	**Don Antonio Ulloa**		1130	210	0	32	0	iron	12	6	1	1600	3 6-in. B.L.R., 2 3½-in. do., 5 M.	2 f. tu. or l.car	1887	..	14·00	220	—
„	**Don Juan de Austria**		1130	210	0	32	0	iron	12	6	1	1600	3 6-in. B.L.R., 2 3½-in. do., 5 M.	2 f. tu. or l.car	1887	..	14·00	—	—
t.b.c.	**Destructor** (³)		458	192	6	25	0	steel	mean dt. 7	0	2	3800	7 M.	..	1887	..	22·56	—	—
g.v.	**El Cano**		524	157	5	25	7	iron	8	6	2	600	3 12-c.m. B.L.R. (Hontoria), 2 M.	..	1885	..	11·50	80	—
cr.	**Ensenada**		1030	185	0	30	0	steel	11	6	2	—	— — — —	—	—	—	—	—	—
d.v.	**Fernando el Catolico**		500	157	5	25	7	iron	8	5	2	550	1 16-c.m. M.L.R. (Palliser), 2 12-c.m. smooth-bores, 1 M.	..	1875	..	10·00	20	—
g.v.	**General Lezo**		524	157	5	25	7	iron	8	6	2	600	3 12-c.m. B.L.R. (Hontoria), 2 M.	1 f. tu. or l.car	1885	..	11·00	80	—
fr.cr.	**Gerona**		3980	265	9	49	3	wood	20	8	1	600 (nom.)	21 smooth-bores, 2 l.	..	1864	..	9·00	675	—
sl.	**Infanta Isabel**		1130	210	11	32	2	iron	12	5	2	1500	5 12-c.m. B.L.R. (Hontoria), 5 M., 2 l.	..	1885	..	14·00	220	—
„	**Isabel II.**		1130	210	11	32	2	iron	12	5	2	1500	5 12-c.m. B.L.R. (Hontoria), 5 M., 2 l.	..	1886	..	14·00	220	—
cr.	**Isla de Cuba** *pp.* (²)		1030	185	0	30	0	steel	11	6	2	2200	6 4-¾in. B.L.R., 4 6-pdr. Q.F.	3 f. tu. or l.car	1887	..	16·00	160	—
cr.	**Isla de Luzon** *pp.* (²)		1030	185	0	30	0	steel	11	6	2	2200	6 4¾-in. B.L.R., 4 6-pdr. Q.F.	3 f. tu. or l.car	1887	..	16·00	160	—
„	**Jorge Juan**		935	203	5	29	6	wood	12	2	1	1100	3 16-c.m. 6-ton M.L.R. (Palliser), 2 M., 2 l.	..	1876	..	13·00	130	—
fr. cr.	**Lealtad**		3075	223	2	42	7	wood	20	4	1	1449	26 guns, 4 M., 5 l.	..	1860	..	9·00	350	—
cr.	**Lepanto** (¹)	P.	5000	318	6	50	6	steel	20	0	2	11,000	4 24-c.m. B.L.R., 6 12-c.m. do., 8 Q.F., 8 M.	5 f. tu. or l.car	Bldg.	..	20·00	1100	—
g.v.	**Ligera**		445	147	7	23	7	wood	8	10	1	393	2 16-c.m. M.L.R., 1 12-c.m. smooth-bore, 1 l.	..	1864	..	7·00	180	—
„	**Magellanes**		524	157	5	25	7	iron	8	6	2	600	3 12-c.m. B.L.R. (Hontoria), 2 M.	..	1885	..	11·00	80	—
corv.	**Maria de Molina**		1677	203	5	36	0	wood	16	9	1	435	10 16-c.m. M.L.R. (Palliser), 4 l.	..	1868	..	7·00	330	—
d.v.	**Marques del Duero**		500	157	5	25	7	iron	8	5	2	550	1 16-c.m. M.L.R. (Palliser), 2 12-c.m. smooth-bores, 1 M.	..	1875	..	10·00	90	—

SPAIN.—Unarmoured Ships—*continued.*

corv., corvette; *cr.*, cruiser; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *t.b.c.*, torpedo boat-catcher; P, deck protected throughout; *pp.*, partial deck protected; f. tu., l. car., fixed tube or launching carriage for Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
cr.	**Navarra**	3342	232	11	42	7	wood	20	4	1	4400	8 16-c.m. B.L.R. (Hontoria), 2 8·7-c.m. do. (Krupp), 2 M., 4 l.	..	1881	..	14·00	470	—
fr.cr.	**Navas de Tolosa**	4460	265	9	49	3	wood	22	4	1	600 (nom.)	22 16-c.m. M.L.R. (Palliser), 4 16-c.m. smooth-bores, 4 l.	..	1865	..	7·00	670	—
g.v.	**Prosperidad**	420	141	0	22	7	wood	9	7	1	134	2 16-c.m. smooth-bores, 1 M., 1 l.	..	1865	..	6·00	80	—
cr.	**Reina Christina**	3090	278	10	42	7	steel	16	5	1	4800	8 16-c.m. B.L.R. (Hontoria), 4 9-c.m. do., 2 M., 2 l.	5 f. tu. or l.car	1887	..	17·50	600	—
„	**Reina Mercedes**	3090	278	10	42	7	steel	16	5	1	4860	8 16-c.m. B.L.R. (Hontoria), 4 9-c.m. do., 2 M., 2 l.	5 f. tu. or l.car	1887	..	17·50	600	—
„	**Reina Regente** (1) P.	5000	318	6	50	6	steel	20	0	2	11,000	4 24-c.m. 21-ton B.L.R., 6 12-c.m. do., 8 Q.F., 8 M.	5 f. tu. or l.car	1887	..	20·70	1100	—
sl.	**Sanchez Barcaistegui**	935	203	5	29	6	wood	12	2	1	1100	3 16-c.m. 6-ton M.L.R. (Palliser), 2 M., 2 l.	..	1876	..	13·00	130	—
d.v.	**San Quentin**	1300	246	0	32	10	iron	11	6	1	1500	3 12-c.m. B.L.R. (Hontoria), 1 M., 2 l.	..	1856	..	10.00	360	—
g.v.	**Sirena**	445	147	7	22	11	wood	9	6	1	227	1 16-c.m. M.L.R. (Palliser), 2 12-c.m. smooth-bore, 2 l.	..	1863	..	8·00	95	—
corv.	**Tornado** (Torpedo School ship)	2090	219	10	32	10	composite	14	5	1	328 (nom.)	2 16-c.m. M.R.L. (Palliser), 2 12-c.m. smooth-bores, 2 l.	..	1866	..	9·00	350	—
g.v.	**Valiente**	733	150	1	25	11	iron	7	10	1	380	1 16-c.m. M.R.L. (Palliser) 1 12-c.m. smooth-bores, 2 l.	..	1860	..	5·00	130	—
sl.	**Velasco**	1152	209	11	29	3	iron	12	5	1	1500	3 15-c.m. 4-ton B.R.L. (Armstrong), 1 M., 2 l.	..	1881	..	14·30	220	—
„	**Vencedora**	778	177	2	26	3	wood	12	5	1	200	2 16-c.m. smooth-bores, 1 12-c.m. do., 2 l.	..	1861	..	8·00	210	—

NOTES ON THE SPANISH NAVY.—UNARMOURED SHIPS.

Besides paddle vessels, Ferrolano, Gaditano, Liniers, and training ships and transports, there are on the Spanish lists:—

Gunboats. — Alsedo, Cocodrillo, Cuba Española, Eulalia, Paz, Pelicano, Pilar, Salamandra (216 to 242 tons), 199 to 240 indicated horse-power.

Small steamers, classed as third class gunboats, forty-three (33 to 179 tons).

Torpedo Gunboat El Destructor, of 458 tons, 3800 horse-power, and 22·56 knots speed.

Torpedo boats.—Two seagoing torpedo boats of the Ariète type, of 26·11 knots speed; two torpedo boats of the Falke type, 108 tons displacement, and 23 knots; and ten other first class boats.

(1) REINA REGENTE.

Reina Regente.

The Royal Spanish cruiser, Reina Regente, proceeded down the Clyde on the 10th of October, 1887, for her official trial under steam.

For four hours continuously she is stated to have been propelled at the rate of 20·73 knots an hour. The Reina Regente belongs to the "protected" type of ship, and is the largest of that type yet built in this country.

For protection she depends partly upon an armoured deck of steel 4¾ in. thick on the sloping sides, and 3 in. in the flat portion at the middle; and partly upon the large subdivision of the ship above and below the protective deck. Between the protective deck and the one immediately above it, *i.e.* between wind and water, there are eighty-three separate compartments. Most of these are used for coal bunkers, and it is here that most of the coal is stowed, only 160 tons being stowed below the protective deck.

Below the protective deck there are no less than sixty separate

Reine Regente.

compartments. A double bottom extends from side to side, and throughout the whole length of the ship.

The engines consist of two sets of the triple expansion type, and they are placed horizontally in separate compartments immediately under the protective deck. The ship is propelled by twin screws, each driven by one set of engines, and supplied by steam from four boilers. The power developed on this trial was equal to 11,000 horses. This in a vessel of the size is very great. Her length is 330 ft. over all, 318½ ft. between the perpendiculars; breadth 50½ ft., and draught of water 20 ft.; displacement at this draught, with 500 tons of coal on board, is 5000 tons. The armament includes four 24-centimetre Hontario (21-ton) guns, six 12-centimetre Hontario guns, eight 6-pounder Nordenfelt guns, eight small machine guns, and five above-water torpedo tubes, viz. two forward, one on each broadside, and one abaft. There are no less than forty-three separate engines on board. The vessel is also fitted with two powerful search lights.

(2) ISLA DE LUZON; ISLA DE CUBA.

Isla de Luzon; Isla de Cuba.

These small steel cruisers were built at Elswick, and launched at the end of the year 1886. Their length is 185 feet, breadth 30 ft., mean draught of water 11 ft. 6 in., displacement 1030 tons. There are triple expansion engines of 2200 horse-power, and the speed 16 knots. The armament consists of six 12-centimetre B.L. guns, and four quick-firing Hotchkiss guns.

(3) EL DESTRUCTOR.

El Destructor.

The Destructor was built by Messrs. James and George Thomson, of Glasgow, for the Spanish Government. She attained on trial a speed of 22·6 knots as the mean of two runs, each of three hours' duration. Her consumption trials showed that she had a radius of action of about 5500 knots, at a speed of about 10 knots. She is well subdivided, but, excepting abreast of the engines where she has thick plating on the bunker side for protection against machine gun-fire, she has only coal protection throughout. Her machinery consists of four locomotive boilers, each in separate compartments, and two sets of vertical engines, also in separate compartments. She has three torpedo tubes, two worked from the bow, and one through

El Destructor.

the stern. She has also one 9-centimetre gun on the forecastle, four 6-pounders, and two 42-millimetre Hotchkiss revolvers. She carries a crew of 45 men and provisions for three months. She has a light fore and aft rig, but her masts are hinged, so that her rig can be completely dismantled in a few minutes.

Her dimensions are:—Length, 192½ ft.; breadth, 25 ft.; mean load draught of water, 7 ft.; displacement, 458 tons; indicated horse-power, 3800, and speed 22·56 knots.

ARIÈTE TORPEDO BOAT.

Ariète Torpedo Boat.

This vessel, built by Thornycroft, of Chiswick, was tried in July 1887, and attained the highest speed ever reached by any vessel of her class; which is equivalent to saying that she is the swiftest vessel in the world. She is a high-sided boat, but of no great depth under water, the light draught, about 5 ft. loaded, being a favourable feature in the design.

She is a twin-screw first-class torpedo boat, built of steel throughout. Her length is 147 ft. 6 in., and her beam 14 ft. 6 in. The hull is divided into twelve water-tight compartments, all except one, that in the torpedo room, being carried up to the deck. The torpedo room bulkhead, however, has its top well above the water line. Any two of the compartments can be filled without sinking the boat. In order to facilitate communication, the bulkheads are pierced, but are fitted with water-tight doors. There will be three masts, the spread of canvas being equal to 1685 square feet. The vessel is lit throughout by electricity. There are altogether 23 incandescent lights, the current being obtained from a dynamo machine which is driven by a Parsons high-speed engine supplied by Messrs. Clark, Chapman, Parsons, and Co., and placed in the torpedo compartment. The same dynamo and engine are used for the search light when required. In such case, of course, ordinary lamps would have to be used for the lighting of the interior of the vessel.

She has two torpedo tubes built into the boat forward, and the torpedoes are to be ejected by air impulse. Four torpedoes, 14 ft. 6 in. long by 14 in. in diameter, will be carried, two in the tubes and two stowed below. There is only bow discharge. The gun armament is however an important feature, there being four 1·65-in. Nordenfelt guns, two on the conning towers and two broadside.

Amongst other features it may be noticed that the funnels are placed diagonally across the boat, and are of oval section. The projector is mounted on a slide running on a bridge that stretches across the vessel amidships.

Arièto Torpedo Boat.

The following is the abstract of the official steam trials at the measured knot:—

Number of Run.		Pressure in Boiler.	Vacuum in Condenser.	Pressure in Receiver.	Air Pressure in Stokehold.	Revolutions per Minute.	Observed Time.
		lb.	in.	lb.	ins. water.		mins. secs.
Port engines.	1	151	26	48	3⅞	388	2 26
	2	152	26	48	3⅞	388	2 14
	3	151	26	48	3¾	393	2 25½
	4	152	26	49	3⅞	392	2 12½
	5	152	26	49	3¾	396	2 22½
	6	153	26	49	3½	396	2 11½
	Means	151·8	26	48·5	3¾	392	
Starboard engines.	1	151	26	46	3⅞	394	2 26
	2	152	26	45	3⅞	394	2 14
	3	151	26	46	3¾	394	2 25½
	4	152	26	47	3⅞	396	2 12½
	5	152	25½	46	3¾	398	2 22½
	6	153	26	47	3½	397	2 11½
	Means	151·8	25·8	46·1	3¾	395·5	

True mean speed 26·003 knots. Draught forward, 1 ft. 9 in.; aft 4 ft. 11 in. Weather fine. The six runs were made at the beginning of the two hours. Total weight carried, exclusive of boat and propelling machinery, 17·35 tons.

TWO HOURS' CONTINUOUS RUN RECORD TAKEN EACH HALF-HOUR.

Steam Pressure.		Vacuum.	Pressure in Receiver.	Air Pressure in Stokehold.	Revolutions.
	lb.	in.		ins. water.	
Port engine . . .	142	26½	44	3¾	11,097
	145	26	44	3¾	11,535
	144	26	43	3¾	11,101
	125	25½	38	3½	10,908
Starboard engines . . .	142	25	42	3¾	11,260
	145	25½	43	3¾	11,660
	144	25	42	3¾	11,330
	125	25½	35	3½	11,015

Mean speed for two hours' run 24·9 knots per hour.

The most economical speed of the boat is 10·3 knots per hour, at which rate of steaming she burnt 186·6 lb. of coal per hour. The consumption would be 8·07 tons for a thousand knots. Her radius of action is 2500 knots at 10 knots. The collective horse-power at full speed is about 1550 indicated, divided pretty equally between the two pairs of engines. There are fifteen bilge ejectors each capable of discharging 35 tons per hour, and two of Tangyes' special donkey pumps are placed in the engine-room, each throwing 1250 gallons an hour (Fig. 8). The electric light projector is a 16 in. Mangin.

SWEDEN.—Armoured Ships.

a.g.b., armoured gunboat; *c.s.*, coast-service vessel; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.		Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
								Turret.	Water-line.						Guns.	Fish Torpedo Dis-chargers					
			tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
a.g.b.	**Berserk** .	(iron)	452	131	3	29	6	14	2½	34	8	3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1874	..	8·00	19	—
„	**Bjorn** .	(iron)	457	131	3	26	3	14	2½	34	8	3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1874	..	8·00	19	—
„	**Fenris** .	(iron)	259	104	11	22	4	11	2	34	7	10	1	44	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1872	..	6·00	7	—
„	**Folke** .	(iron)	460	131	3	26	3	14	2½	34	8	3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1875	..	8·00	19	—
„	**Garmer** .	(iron)	268	91	10	22	11	6	2	8	7	7	1	90	1 27-c.m. 24-ton B.L.R., 2 M. . .	..	1868	..	6·00	15	—
„	**Gerda** .	(iron)	457	131	3	26	3	14	2½	34	8	3	2	133	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1873	..	8·00	19	—
„	**Hildur** .	(iron)	457	131	3	26	3	14	2½	34	8	3	2	133	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1872	..	8·00	19	—
c.s., *t.*	**John Ericsson**	(iron)	1500	200	2	45	11	11	4½	31½	11	6	1	380	2 24-c.m. 15-ton B.L.R., 2 M. . .	..	1865	..	6·00	112	—
„	**Loke** .	(iron)	1600	205	3	45	11	18	4	40	11	10	1	430	2 24-c.m. 15-ton B.L.R., 3 M. . .	..	1871	..	7·00	112	—
a.g.b.	**Skold** .	(iron)	247	104	11	22	4	9	1	34	8	3	1	17	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1869	..	4·00	5	—
„	**Solve** .	(iron)	454	131	3	29	6	14	2½	34	8	3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1875	..	8·00	19	—
t.	**Svea** (¹) .	(steel)	2900	249	4	49	3	11½	11½	11½	15	9	2	3100	2 10-in. 27-ton B.L.R. (Armstrong), 4 6-in. 4-ton do., 6 M.	6 f. tu. or l. car	1886	127,300	15·45	200	800 at 12 knots.
c.s., *t.*	**Thordon** .	(iron)	1500	200	2	45	11	11	4½	26	11	6	1	380	2 24-c.m. 15-ton B.L.R., 2 M. . .	..	1866	..	6·00	112	—
„	**Tirfing** .	(iron)	1500	200	2	45	11	11	4½	26	11	6	1	380	2 24-c.m. 15-ton B.L.R., 2 M. . .	..	1867	..	6·00	112	—
a.g.b.	**Ulf** . .	(iron)	457	131	3	26	3	14	2½	34	8	3	2	155	1 24-c.m. 15-ton B.L.R., 2 M. . .	..	1878	18,000	8·00	20	—

SWEDEN.—Unarmoured Ships.

corv., corvette; *fr. cr.*, frigate-built cruiser; *g.v.* gun-vessel; *tor. ship*, torpedo ship; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.	Beam.	Material of Hull.	Draught of Water.	Propeller.	Indicated Horse-power.	Armament. Guns.	Armament. Fish Torpedo Dischargers.	Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
		tons.	ft. in.	ft. in.		ft. in.						£	knots.	tons.	knots.
corv.	**Balder**	1886	203 5	36 0	wood	18 4	1	1380	4 15-c.m. B.L.R. (Armstrong), 2 12-c.m. B.L.R., 6 M., 1 l.	..	1870	..	12·00	200	940
g.v.	**Blenda**	500	167 4	25 11	iron	9 2	2	590	1 27-c.m. 24-ton B.L.R. (Armstrong), 1 12-c.m. B.L.R., 2 M.	..	1875	..	12·00	98	—
"	**Disa**	500	167 4	25 11	"	9 2	2	590	1 27-c.m. 24-ton B.L.R. (Armstrong), 1 12-c.m. B.L.R., 2 M.	..	1877	..	12·00	98	—
tor. ship.	**Drott (was Ran)**	630	173 10	26 3	"	9 6	2	960	4 Engström, Q.F.	3 f. tu. or l.car	1877	..	13·00	100	1000
g.v.	**Edda**	640	180 5	27 3	"	9 6	2	960	1 27·4-c.m. 27-ton B.L.R., 1 15-c.m., do. 4 M.	..	1882	..	13·00	80	—
corv.	**Freja**	2000	216 6	39 4	steel & wood	18 9	1	1750	4 15-c.m. 4-ton B.L.R., 8 12-c.m. do., 8 M.	..	1885	..	12·00	180	—
g.v.	**Rota**	537	170 7	26 3	iron	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1878	..	13·00	80	—
corv.	**Saga**	1535	200 2	32 10	wood	17 1	1	900	1 15-c.m. 5-ton B.L.R. (Armstrong), 6 12-c.m. B.L.R., 4 M., 2 l.	..	1878	..	11·00	170	—
g.v.	**Skaggald**	537	170 7	26 3	iron	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1879	..	13·00	80	—
"	**Skagul**	537	170 7	26 3	"	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1878	..	13·00	80	—
"	**Skuld**	537	170 7	26 3	"	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1880	..	13·00	80	—
"	**Urd**	537	170 7	26 3	"	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1877	..	13·00	80	—
fr. cr.	**Vanadis**	2136	200 11	42 7	wood	20 1	1	1400	8 17-c.m. 5-ton B.L.R., 8 16-c.m. 3-ton shell guns, 4 M.	..	1862	..	11·00	235	—
g.v.	**Verdande**	537	170 7	26 3	iron	9 2	2	780	1 27-c.m. 24-ton B.L.R., 1 12-c.m. do., 2 M.	..	1879	..	13·00	80	—

Gunboats.—Alfhild, Aslog, Astrid, Gunhild, Hagland, Ingegerd, Motala, Sigrid (180 to 195 tons; 170 to 180 indicated horse-power).

Torpedo boats.—Four of 60 to 65 tons and 18 knots speed, five other first class boats of 40 tons displacement and 18 to 16 knots speed, and seven other boats of smaller size and less speed.

The Swedish navy has also training ships, transports, surveying vessels, and some steamers of old construction.

NOTES ON THE SWEDISH NAVY.

(1) SVEA.

The Svea.

The Svea, referred to at p. 277 of *The Naval Annual* for 1886, had her steam trials in July 1886, when she attained a speed of 15·45 knots. Her dimensions are given in the alphabetical list of armoured ships. The ship is armoured with steel 11½ to 8 in. thick on the sides. The armour extends from 3 ft. above the water-line to 2 ft. below it. That on the forward bulkhead is from 12 to 11 in. thick, and that on the after bulkhead 11 to 8 in. thick. The one revolving turret, which is forward, is covered with compound armour 11½ to 9½ in. thick. There is a 2-in. protective iron deck.

The armament is two 10-in. B.L.R. (Armstrong) in the turret, four 6-in. Armstrong B.L. guns, six machine guns, and six Whitehead torpedo dischargers.

There is one military mast. The complement of men and officers is 150.

TURKEY.—Armoured Ships.

a.g.b., armoured gunboat; *br.*, broadside ship; *c.b.*, central-battery ship; *t.*, turret ship; f. tu., l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Turret or Battery.	Belt.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
c.b.	**Assar-i-Schefket** .(iron)	2080	203	5	42	7	4½	6	9	16	5	2	1750	5 8-in. 7-ton M.L.R. (Armstrong), 2 M. .	..	1868	..	11·00	300	—
,,	**Assar-i-Tevfik** .(iron)	4687	272	4	52	6	6	8	9	·24	11	1	3560	8 9-in. 12-ton M.L.R. (Armstrong), 2 M. .	..	1868	..	13·00	400	—
,,	**Avni-Illah** . . .(iron)	2400	226	4	36	0	5	6	10	16	5	1	2200	4 9-in. 13-ton M.L.R. (Armstrong), 2 M. .	..	1869	..	12·00	220	—
br.	**Azazieh** . . .(iron)	6400	292	0	55	9	5	5¼	9	25	7	1	3735	1 9-in. 12-ton M.L.R. (Armstrong), 17 8-in. 7-ton do., 2 M.	..	1864	..	13·00	750	—
c.b.	**Feth-i-Bulend** . .(iron)	2806	236	3	39	4	6	9	10	18	1	1	3250	4 9-in. 12-ton M.L.R. (Armstrong), 1 7-in. 6-ton do., 2 M.	..	1869	..	13·00	300	—
a.g.b.	**Feth-el-Islam** . .(iron)	335	101	9	24	7	3	3	10	5	11	1	290	2 4-in. guns.	..	1864	..	8·00	20	—
c.b.	**Hamidieh** . . .(iron)	6700	292	0	55	9	5	9	18	24	10	1	6800	10 24-c.m. 13-ton B.L.R. (Krupp), 2 17-c.m. 6-ton do., 6 l., 2 M.	..	1885	..	13·00	600	—
a.g.b.	**Hisber** (was Nusritieh) (iron)	404	144	4	30	10	3	3	5½	5	7	1	400	2 12-c.m. B.L.R. (Krupp)	..	1875	..	7·00	20	—
t.	**Hufzi-el-Rahman** .(iron)	2540	204	0	45	11	5	4½	10	14	5	1	200 nom.	2 9-in. 12-ton M.L.R. (Armstrong), 2 7-in. 6-ton do., 1 5-in. do., 2 M.	..	1868	..	12·00	200	—
c.b.	**Idjilalieh** . . .(iron)	2266	213	3	42	7	4·5	6	13	17	4	1	1800	2 9-in. 12½-ton M.L.R. (Armstrong), 3 7-in. 6-ton, 2 M.	..	1870	..	11·00	300	—
br.	**Mahmudieh** . .(iron)	6400	292	0	55	9	5	5¼	9	25	7	1	3735	1 9-in. 12-ton M.L.R. (Armstrong), 17 8-in. 6-ton do., 2 M.	..	1864	..	12·00	750	—
a.g.b.	**Meindooyeh** (was Semen-drieh) . . .(iron)	335	101	9	24	7	3	3	10	5	11	1	290	2 4-in. guns	..	1864	..	8·00	20	—
c.b.	**Mesoodieh** . . .(iron)	9120	331	5	59	0	10	12	10	25	11	1	7431	12 10-in. 18-ton M.L.R. (Armstrong), 3 7-in. 6-ton do., 2 M., 6 l.	..	1874	..	13·00	600	—
,,	**Muin-i-Zaffer** . .(iron)	2400	230	0	36	0	5	6	10	16	5	2	2200	4 9-in. 12-ton M.L.R. (Armstrong), 2 M. .	..	1869	..	12·00	220	—
c.b.	**Mukadim-i-Hair** .(iron)	2806	236	3	39	4	6	9	10	18	1	1	3000	4 9-in. 12-ton M.L.R. (Armstrong), 1 7-in. 6-ton do., 2 M.	..	1872	..	12·00	300	—
c.b.	**Nedjim-i-Schefket** .(iron)	2080	203	5	42	7	4¼	6	9	16	5	2	1900	5 8-in. 7-ton M.L.R. (Armstrong), 2 M. .	..	1868	..	11·00	300	—
b.r.	**Orkanieh** . . .(iron)	6400	292	0	55	9	5	5¼	9	25	7	1	3735	1 9-in. 12-ton M.L.R. (Armstrong), 17 8-in. 6-ton do., 2 M.	..	1865	..	12·00	750	—
,,	**Osmanieh** . . .(iron)	6400	292	0	55	9	5	5¼	9	25	7	1	3735	1 9-in. 12-ton M.L.R. (Armstrong), 17 8-in. 6-ton do., 2 M.	..	1864	..	12·00	750	—

TURKEY.—Unarmoured Ships.

fr.cr., frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; *t.g.*, torpedo gunboat.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Nominal Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
g.v.	**Beyruth**	609	173	6	26	7	..	12	10	1	160	1 6-in. 3-ton B.L.R., 1 4¾-in. do., 6 40-pdr.	..	1863	..	10·00	120	—
sl.	**Brussa**	800	172	6	30	6	wood	15	2	1	150	2 6-in. B.L.R., 8 4¾-in. do.	..	1859	..	11·00	120	—
”	**Edirneh**	782	172	6	30	6	wood	14	2	1	150	2 6-in. 5-ton B.L.R., 10 4¾-in. do.	..	1859	..	11·00	120	—
fr.cr.	**Ertogrul**	2344	250	0	49	10	wood	23	7	1	600	21 6-in. 3-ton B.L.R., 20 4¾-in. do.	..	1863	..	10·00	350	—
gv.	**Iskenderieh**	609	173	6	26	7	wood	12	10	1	160	1 6-in. 3-ton B.L.R., 1 4¾-in. do., and 640-pdr.	..	1863	..	11·00	120	—
sl.	**Mansureh**	800	174	10	30	6	wood	15	2	1	150	2 6-in. B.L.R., 8 4¾-in. do.	..	1863	..	11·00	120	—
”	**Mehemet Selim** . . .	1300	196	10	32	10	wood	16	6	1	450	21 6-in. 3-ton B.L.R.		1875	..	11·00	250	—
g.v.	**Mehrieh**	609	173	6	26	7	wood	12	10	1	160	2 4¾-in. B.L.R.	..	1863	..	10·00	120	—
fr.cr.	**Much bir-i-Surur** (Torp. Sch.)	1477	209	11	38	0	..	17	5	1	450	22 guns . . .	..	1879	—	—	—	—
sl.	**Muzafer**	800	174	10	30	6	wood	15	2	1	150	2 6-in. 5-ton B.L.R., 10 4¾-in. do.	..	1863	..	12·00	150	—
”	**Sedul Bahr**	609	173	6	26	7	wood	12	10	1	160	2 4¾-in. B.L.R. . .	..	1859	..	10·00	120	—
fr.cr.	**Selimieh**	4717	279	10	59	0	wood	23	7	1	600	25 6-in. 3-ton B.L.R., 24 4¾-in. do.	..	1865	..	10·00	350	—
sl.	**Sinope**	800	172	0	30	6	wood	15	0	1	150	1 6-in. 5-ton B.L.R., 8 4¾-in. do.	..	1859		10·00	120	—
t.g.	Not named	260	200	0	20	3	steel	8	0	2	2700	1 4-in. B.L.R., 6 M.	..	Bldg.	..	21·00	—	—
g.v.	**Uthared**	609	173	6	26	7	wood	12	10	1	160	2 4¾-in. B.L.R. . .	..	1863	..	10·00	120	—
”	**Zuhaf**	609	173	6	26	7	wood	12	10	1	160	2 4¾-in. B.L.R. . .	..	1862	..	10·00	120	—
sl.	Not named	1960	226	0	37	0	composite	14	0	1	2500	2 6-in. 5-ton B.L.R., 4 4¾-in. do.	..	Bldg.	..	14·00	—	—
”	Not named	1160	210	0	35	0	composite	14	0	1	1800	2 6-in. 5-ton B.L.R., 4 4¾-in. do.	..	Bldg.	..	14·00	—	—

27 *Despatch Vessels and Yachts.*—Ainaly-Kawak, Arcadia, Candia, Chania, Esser-i-Djidid, Esser-i-Neiseret, Faiz-i-Bahri, Fevaid, Iksan, Ismail, Izzedin, Moodar-î-Zaffer, Monassir Noodoosche-i-Reisan, Peih-i-Tidjaret, Rethimo, Rhodos, Sahir, Seyar, Seyar-i-Derja Soolhie, Stamboul, Stankio, Sultanieh, Surreya, Syrat, Thalia of 184 tons to 1512 tons displacement, and 50 H.P. to 800 H.P. About one-half of these vessels are built of wood.

4 *Gunboats.*—Akha, Frat, Shefket Numa, and Sholt of 200 tons displacement and 60 H.P., and about 10 knots speed.

Torpedo boats.—In addition to the torpedo gunboat given in the alphabetical list of unarmoured vessels, there are 19 first class torpedo boats built and building, 8 of 88 tons and of 20 to 22 knots speed.

There are also, in addition to the vessels named in the lists, screw and paddle transports and store ships, harbour ships and vessels, tugs, &c., &c.

UNITED STATES.—Armoured Ships.

c.s., t., coast-service turret ship; *to. ram*, torpedo ram.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Mean Draught of Water.		Propeller.	Indicated Horse power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Turret or Battery.						Guns.	Fish Torpedo Dischargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
c.s., t.	**Ajax** (1 turret) (iron).	2100	226	4	42	7	5	11	..	13	9	2	320	2 15-in. 19-ton smooth-bores	..	1864	..	6·00	160	—
to. ram	**Alarm** (iron)	720	172	6	29	3	4 (on traverse)	..	16	11	2	1	800	1 15-in. smooth-bore	..	1873	..	11·00	—	—
c.s., t.	**Amphitrite** (2 t.) (iron)	3815	249	4	55	9	7	14	..	14	3	2	1600	4 10½ 25-ton B.L.R., 8 M.	..	1883 (rebuilt)	..	10·00	300	1800
„	**Camanche** (1 t.) (iron)	1875	200	2	45	11	5	11	..	11	6	2	350	2 11-in. smooth-bores	..	1863	..	6·00	160	—
„	**Canonicus** (1 t.) (iron)	2100	226	4	42	7	5	11	..	13	9	2	320	2 15-in. 19-ton smooth-bores	..	1864	..	6·00	160	—
„	**Catskill** (1 t.) (iron)	1875	200	2	45	11	5	11	..	11	6	2	350	2 11-in. smooth-bores	..	1863	..	6·00	150	—
to. ram	**Intrepid** (iron)	1123	170	7	36	0	5	..	14	11	10	2	800	..	..	1874	..	9·00	—	—
c.s., t.	**Jason** (1 t.) (iron)	1875	200	2	45	11	5	11	..	13	6	2	350	2 11-in. smooth-bores	..	1864	..	6·00	150	—
„	**Lehigh** (1 t.) (iron)	1875	200	2	45	11	5	11	..	13	6	2	350	2 11-in. smooth-bores	..	1864	..	6·00	150	—
„	**Mahopac** (1 t.) (iron)	2100	226	4	42	7	5	11	..	13	9	2	320	2 15-in. 19-ton smooth-bores	..	1865	..	6·00	160	—
„	**Manhattan** (1 t.)(iron)	2100	226	4	42	7	5	11	..	13	9	2	320	2 15-in. 19-ton smooth-bores	..	1865	..	6·00	160	—
„	**Miantonomoh** (2 t.) (iron)	3815	249	4	55	9	7	14	8	14	3	2	1600	4 10½-in 25-ton B.L.R., 8 M.	..	1883 (rebuilt)	272,000	10·00	330	1800
„	**Monadnock** (2 t.) (iron	3815	249	4	55	9	7	14	8	..		2	1600	4 10½-in. 25-ton B.L.R., 8 M.	..	1883 (rebuilt)	272,000	10·00	330	1800
„	**Montauk** (1 t.) (iron)	1875	200	2	45	11	5	11	..	11	6	2	350	2 11-in. smooth-bores	..	1864	..	4·00	160	—

UNITED STATES.—Armoured Ships.—(*continued.*)

c.s., t., coast service turret ship ; *to. ram*, torpedo ram.

Class.	NAME.	Displacement.	Length.		Beam.		Armour.		Backing.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
							Belt.	Turret or Battery.						Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.	inches.	inches.	inches.	ft.	in.						£	knots.	tons.	knots.
c.s., t.	**Nahant** (1 t.) (iron) .	1875	200	2	45	11	5	11	..	11	6	2	350	2 11-in. smooth-bores . .	..	1863	..	6·00	160	—
”	**Nantucket** (1 t.) (iron)	1875	200	2	45	11	5	11	..	11	6	2	350	2 11-in. smooth-bores . .	..	1863	..	5·00	160	—
”	**Passaic** (1 t.) (iron) .	1875	200	2	45	11	5	11	..	11	6	2	350	2 11-in. smooth-bores . .	..	1863	..	6·00	160	—
”	**Puritan** (iron) . .	6000	278	10	59	0	7	12	..	18	1	2	3700	4 10½-in. 25-ton B.L.R., 8 M. .	..	1883 (rebuilt)	..	13·00	580	—
”	**Saugus** (1 t.) (iron) .	2100	226	4	42	7	5	10	..	13	9	2	320	2 15-in. 19-ton smooth-bores .	..	1864	..	6·00	160	—
”	**Terror** (iron) . .	3815	249	4	55	9	7	14	8	14	3	2	1600	4 10½-in. 25-ton B.L.R., 8 M. .	..	1883 (rebuilt)	206,800	13·00	330	1800
”	**Wyandotte** (iron) .	2100	225	0	43	7	5	10	..	13	6	1	320	2 15-in. (19-ton) M.L.R. . .	..	1864	..	6·00	160	—

NOTES ON THE UNITED STATES NAVY.—ARMOURED SHIPS.

The American Government appointed a Board to consider plans for the new cruisers, for which tenders were asked from both American and foreign designers.

The Board reports that none of the designs submitted is quite suitable, but that submitted by the Barrow Shipbuilding Co., of England, promised well. The design presents the somewhat remarkable feature possessed by many French ships of having the water-line well protected by heavy armour, and also the guns on the upper deck, but of leaving the intermediate space between the upper and lower decks wholly without protection. The buoyancy of the ship is well assured by a protective deck at the top of the water-line armour. There are two turrets *en echelon*—that is to say, not in the middle of the ship, but on either side of the middle-line, so that their guns can fire directly forward or aft, or to either side.

The Board came to no decision in the selection of a design for the armoured cruiser. To provide for such a contingency, the Bureau of Construction of the Navy Department had prepared original plans for both an armoured battle-ship and cruiser. These designs were not submitted for competition, but were held in reserve in case no suitable designs were received from private sources. As the Board has failed to find a design suitable for the cruisers, the Bureau plans for that vessel will doubtless be used. The plan of this ship has many points of resemblance to the Brazilian turret-ship Riachuelo, although many improvements in the original model have been introduced. The general dimensions are as follows:—Length, 310 ft.; breadth, 54 ft.; draught, 21 ft. 6 in.; displacement, 6600 tons; speed, 17 knots; coal capacity, 800 tons. Four 10-in. guns are carried in turrets *en echelon,* and six 6-in. guns are mounted in central pivot carriages, so arranged that all of the 10-in. and three of the 6-in. guns can be concentrated on one point of fire, while thirteen rapid-fire guns have practically an all-round range. The armour belt is seventeen in. in thickness and six ft. in breadth. The vessel is fitted with torpedo tubes for the discharge of fish torpedoes, carries two steam torpedo boats, and is rigged as a barque.

UNITED STATES.—Unarmoured Ships.

corv., corvette; *cr.*, cruiser; *fr.cr.*, frigate-built cruiser; *g.v.*, gun-vessel; *sl.*, sloop; P., deck protected throughout; *p.p.*, partial deck protected; f. tu. l. car., fixed tube or launching carriage for discharging Fish torpedoes.

Class.	NAME.	Displacement.	Length.		Beam.		Material of Hull.	Mean Draught of Water.		Propeller.	Indicated Horse-power.	Armament.		Date of Launch.	Cost.	Speed.	Coal Supply.	Distance that can be steamed at 10 knots.
												Guns.	Fish Torpedo Dis-chargers					
		tons.	ft.	in.	ft.	in.		ft.	in.						£	knots.	tons.	knots.
sl.	**Adams** . . .	1375	183	9	36	0	wood	14	2	1	800	1 8-in. 8-ton smooth-bore, 4 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1874	..	9·00	140	—
g.v.	**Alert**	1020	173	10	31	10	iron	13	0	1	656	1 8-in. 7¾-ton smooth-bore, 2 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1874	..	9·00	140	—
sl.	**Alliance** . . .	1375	183	9	36	0	wood	14	2	1	774	1 8-in. 8-ton smooth-bore, 4 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1875	..	9·00	130	—
cr.	**Atlanta** (²) *p.p.* . .	3000	270	0	42	0	steel	17	0	1	3345	2 8-in. 11¾-ton B.L.R., 6 6-in. 5-ton do., 8 M.	..	1884	123,600	15·50	500	5000
"	**Baltimore** (¹) . P.	4400	315	0	48	6	"	19	6	2	10750	4 8-in. 11¾-ton B.L.R., 6 6-in. 5-ton do., 6 6-pdr. Q.F., 10 M.	5 f. tu. or l.car	Building	..	20·00	900	12,000
"	**Boston** *p.p.* . .	2000	270	0	42	0	"	16	5	1	3500	2 8-in. 11¾-ton B.L.R., 6 6-in. 5-ton do., 8 M.	..	1884	123,600	15·00	780	4000
fr. cr.	**Brooklyn** . .	3000	232	11	42	7	wood	19	4	1	1165	12 9-in. 4-ton smooth-bores, 2 100-pdr. do.	..	1858	..	7·00	275	—
"	**Charleston** (³) . P.	3730	300	0	46	0	"	18	6	2	7500	2 10-in. B.L.R., 6 6-in. 5-ton do. . .	5 f. tu. or l.car	Building	..	19·00	800	—
"	**Chicago** *p.p.* .	4500	325	0	48	2	steel	19	0	2	5000	4 8-in. B.L.R., 8 6-in. do., 2 5-in. do., 6 M.	..	1885	177,800	15·00	940	—
d.v.	**Dolphin** . . .	1485	239	6	31	10	"	14	2	1	2300	1 6-in. 5-ton B.L.R., 4 M.	..	1884	61,000	13·00	310	—
cr.	Dynamite Gun Cruiser (⁴)	715	239	0	26	6	"	8	6	2	3200	3 dynamite guns	..	Building	70,000	20·00	28	—
sl.	**Enterprise** . .	1375	183	9	36	0	wood	14	2	1	800	1 8-in. 8-ton smooth-bore, 4 9-in. 4-ton do., 1 60-pdr. do. M.L.R.	..	1874	..	10·00	140	—
"	**Essex**	1375	183	9	36	0	steel	14	2	1	800	1 8-in. 8-ton smooth-bore, 4 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1874	..	10·00	140	—
corv.	**Galena** . . .	1900	216	6	36	0	"	16	5	1	940	1 8-in. 8-ton B.L.R., 6 9-in. 4-ton smooth-bores, 1 l.	..	1877	..	10·00	125	—
cr.	Gun-boat No. 1 (⁵) .	1700	230	0	36	0	"	14	0	2	3200	6 6-in. B.L.R., 5 6-pdr. Q.F., 2 M . .	8 f. tu. or l.car	Building	..	17·00	400	—
g v.	Gun-boat No. 2 (⁶) .	870	175	0	31	0	"	11	7	1	1350	4 6-in. B.L.R., 2 6-pdr. Q.F., 2 M. . .	..	Building	..	13·00	160	—
fr. cr.	**Hartford** . . .	2900	226	4	42	7	"	18	4	1	696	12 9-in. 4-ton smooth-bores, 1 8-in. 8-ton do., 4 M., 2 l.	..	1858	..	7·00	241	—
corv.	**Iroquois** . . .	1575	200	2	32	10	"	15	1	1	813	2 11-in. 7¾-ton smooth-bores, 4 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1858	..	8·00	128	—
"	**Juniata** . . .	1900	205	5	38	4	"	16	5	1	1804	1 8-in. 8-ton smooth-bore, 4 9-in. 4-ton do., 1 60-pdr.	..	1862	..	9·00	235	—

„	**Kearsarge**		1550	196	10	32	10	„	15	9	1	822	2 8-in. 8-ton smooth-bores, 4 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1861	..	9·00	165	—
„	**Lackawanna**		2200	235	0	38	0	„	15	6	1	950	6 9-in. 4-ton M., 2 8-in. 8-ton M., 1 60-pdr. do.	..	1862	..	9·00	310	—
fr. cr.	**Lancaster**		3250	236	3	45	11	„	19	1	1	2000	10 8-in. smooth-bores, 2 100-pdr. do.	..	1859	..	8·00	288	—
corv.	**Marion**		1900	216	6	37	0	„	16	5	1	1172	6 9-in. 4-ton smooth-bores, 1 8-in. 8-ton B.L.R.	..	1873	..	11·00	156	—
sl.	**Mohican**		1900	216	6	37	0	„	16	5	1	1172	6 9-in. 4-ton smooth-bores, 1 8-in. 8-ton B.L.R.	..	1882	..	11·00	160	—
fr. cr.	**Newark** (⁴)	P.	4033	310	0	49	0	steel	18	9	2	8500	12 6-in. 5-ton B.L.R., 4 6-pdr. Q.F., 8 M.	6 f. tu. or l. car	Building	..	18·00	850	10,500
„	**New York**		4527	314	11	45	11	wood	..		1	8500	.. ..	..	Building since 1865		17·50	900	—
sl.	**Nipsic**		1373	183	9	36	0	„	14	2	1	1375	6 9-in. 4-ton smooth-bores, 1 8-in. 8-ton do., 1 60-pdr. M.L.R.	..	1878	..	11·00	130	—
fr. cr.	**Omaha**		2400	249	4	39	4	„	16	5	1	1150	10 9-in. 4-ton smooth-bores, 1 8-in. 8-ton do., 1 60-pdr. M.L.R.	..	1868	..	12·00	150	—
corv.	**Ossipee**		1900	203	5	39	4	„	16	5	1	1304	1 11-in. 8-ton smooth-bore, 6 9-in. 4-ton do.	..	1861	..	8·00	230	—
fr. cr.	**Pensacola**		3000	229	7	42	7	„	18	9	1	1165	2 11-in. 8-ton smooth-bore, 18 9-in. 4-ton do., 2 60-pdr. M.L.R.	..	1859	..	9·00	310	—
corv.	**Quinnebaug**		1900	216	6	36	0	„	16	5	1	1103	6 9-in. 4-ton smooth-bores, 1 8-in. 8-ton B.L.R.	..	1875	..	9·00	160	—
g.v.	**Ranger**		1020	173	10	31	10	iron	12	10	1	656	1 11-in. 7¾-ton smooth-bore, 2 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1874	..	8·00	127	—
fr. cr.	**Richmond**		2700	226	4	42	7	wood	17	4		1078	12 9-in. 4-ton smooth-bore, 1 8-in. 8-ton do., 1 60-pdr. M.L.R.	..	1860	..	9·00	290	—
„	**Shenandoah**		2100	236	3	39	4	„	16	5	1	1304	6 9-in. 4-ton smooth-bores, 2 8-in. 8-ton do., 1 60-pdr. M.L.R.	..	1863	..	8·00	330	—
corv.	**Swatara**		1900	216	6	36	0	„	16	5	1	1176	6 9-in. 4-ton smooth-bores, 1 8-in. 8-ton B.L.R.	..	1873	..	9·00	186	—
„	**Tennessee**		4840	335	0	45	2	„	21	7	1	1900	2 8-in. 8-ton M.L.R., 4 ·80 pr. Q.L., 16 9-inch 4-ton M.L.	..	1865	..	12·00	420	—
fr. cr.	**Trenton**		3900	252	7	49	3	wood & iron	20	4	1	3100	11 8-in. 8-ton M.L.R. (Palliser's), 6 l.	..	1875	..	14·00	342	—
corv.	**Vandalia**		2100	216	6	39	4	wood	17	4	1	1176	6 9-in. 4-ton smooth-bores, 1 8-in. 8-ton B.L.R.	..	1874	98,726	7·00	218	—
corv.	**Wachusett**		1580	200	0	34	0	„	15	0	1	570	1 11-in. 7¾-ton M., 4 9-in. 4-ton do.	..	1861	..	8·00	172	—
g.v.	**Yantic**		900	180	5	29	6	„	12	2	1	670	1 11-in. 8-ton smooth-bore, 2 9-in. 4-ton do., 1 60-pdr. M.L.R.	..	1878	..	8·00	125	—

Paddle steamers.—Michigan (685 tons and 300 horse-power), Monocacy (1370 tons and 1470 horse-power), Powhattan (3980 tons), Tallapoosa (1270 tons and 1100 horse-power).

Steamers (Fourth Rate), Despatch (560 tons, 402 I.H.P.); Palos (420 tons and 350 horse-power); Fortune, Leyden, Mayflower, Nina, Pinta, Speedwell, Standish, Triana (each 306 tons); Catalpa (191 tons), Cohasset (100 tons), and Rescue (111 tons).

Torpedo boats.—Two 128 feet long, and one 108 feet.

Submarine torpedo boats.—Nautilus, built in London, and the Peacemaker, built in America.

Surveying ships, training ships, store ships, harbour ships, tugs, &c., are not included in the above lists.

NOTES ON THE UNITED STATES NAVY.—UNARMOURED SHIPS.

(1) BALTIMORE.

The Baltimore.

This twin-screw steel protected cruiser is building by contract at Philadelphia. She was commenced in May, 1887. She is a high freeboard ship, with long poop and forecastle. She has a continuous steel deck laid in two thicknesses, 1½ in. on the flat and 4 in. on the slopes. The flat of the deck is slightly above the load water-line.

The conning tower on the after end of the forecastle is built of 3-in. steel plates. The armament will consist of four 8-in. B.L. guns, mounted on either side of the poop and forecastle, at a height of about 28 ft. above the load water-line; six 6-in. B.L. guns, placed on the broadside in sponsons, at a height of 16 ft. above the water. There will also be six 6-pdr. Q.F. guns, six Hotchkiss H.R.C., and four Gatlings. There will be five above-water dischargers—two forward, two on the broadside, and one aft. She will be fitted internally with the electric light, as well as have second lights. The dimensions are given in the alphabetical list. The horse-power given out by the triple expansion engines is expected to be 10,750, and the maximum speed of the ship 20 knots. The normal coal supply is 400 tons, but there is bunker space for 900 tons. With the latter quantity the radius of action of the ship, at 10-knot speed, will be about 12,000 knots.

(2) ATLANTA.

The Atlanta.

The Atlanta, described on page 286 of *The Naval Annual* for 1886, made her full-power steam trials in Long Island Sound on 13th

April, 1887. The ship had her own crew on board, guns, provisions and stores for two and a half months; and 265 tons of coals, out of the total quantity of 500 tons for which there is bunker space. The mean draught of water was 17 ft. The designed mean load draught was 16 ft. 10 in.

The Atlanta.

The mean of the results from the six hours' trial was—steam pressure in boilers, 87 lbs.; indicated horse-power, 3345; speed, 15·5 knots.

(3) CHARLESTON.

The Charleston.

This steel twin-screw protected cruiser is building by contract at San Francisco—the order for her construction having been placed in January, 1887. She is built according to the plans of the Naniwa, Japanese cruiser, described at page 254 of *The Naval Annual* for 1886, and more completely at page 366 of the present volume.

(4) NEWARK.

The Newark.

This twin-screw steel protected cruiser has only just been commenced.

The principal dimensions are:—Length, 310 ft.; breadth, 49 ft.; mean draught of water, 18 ft. 9 in.; displacement, 4033 tons. She will have two military tops, and will be barque-rigged with a spread of 9600 feet of canvas.

The vessel has a double bottom throughout the entire length of the ship, subdivided into numerous water-tight compartments. There is a continuous steel protective deck, 2 in. on the flat, and 3 in. on the slopes.

The conning tower is on the fore-bridge, and is 8 ft. 6 in. in diameter, and built of 3-in. steel plates. A steel communicating tube, 12 in. in diameter and 2½ in. thick, extends in one length from the protective deck to the conning tower, and within it are led speaking tubes, signal lines, &c.

The armament will consist of twelve 6-in. B.L. guns, all mounted on the span deck at a mean height of 16 ft. 6 in. above the load water-line. Also four 6-pdr. quick-firing guns, four Hotchkiss large machine guns, and four Gatlings. There will be six above-water Whitehead torpedo dischargers.

The horse-power of the engines is to be 8500, and the maximum speed of the ship 18 knots. The complement of men and officers is 300. The coal bunkers will stow 850 tons of coal, which will be sufficient for about 10,500 knots, at 10 knots speed.

(5) TORPEDO CRUISER (called Gunboat No. 1).

Gunboat No. 1.

This twin-screw vessel is very similar to those in the British Navy of the Archer class. She is building by contract at Philadelphia, and was commenced in May, 1887.

She has a high freeboard with a long poop and forecastle, and she is rigged as a three-masted schooner. The curved steel deck is ⅜-in. thick, with its crown a little above the 14-ft. water-line.

There is a 2-in. steel-plate conning tower, 7½ ft. athwartships by 4 ft. fore and aft. The armament will consist of six 6-in. B.L. guns, five 6-pdr. quick-firing guns, two large machine guns and one Gatling. She will also have eight above-water fish torpedo dischargers.

The engines will be of the triple expansion type, and will develop 3200 horse-power under forced draft. The estimated speed is 17 knots.

The stowage of coals is 400 tons, and the complement of men and officers 150.

The dimensions are:—Length, 230 ft.; breadth, 36 ft.; mean draught of water, 14 ft. Displacement at that draught, 1700 tons.

(6) Gunboat No. 2.

Gunboat No. 2.

A steel unsheathed single-screw vessel 175 ft. long, 31 ft. broad, mean draught of water 11 ft. 7 in., and displacement 870 tons, is just commenced building by contract at Baltimore. This vessel will carry a fair spread of sail—4853 square feet—and will have three masts. She is well divided by water-tight bulkheads, and over the engines and boilers there is a ⅜-in. curved steel deck with coal stowed on top.

The armament will consist of four 6-in. B.L.R. guns mounted on sponsons, two on each side, at a height of 10 ft. 8 in. above the water-line. The platforms for these guns are four feet above the spar deck. There will be two 6-pdr. quick-firing guns and two large machine guns.

The engines will be compound horizontal, developing 1350 horse-power with forced draft. The estimated speed of the ship is 13 knots. The coal supply is 160 tons, and the complement of men and officers is 100.

(7) THE DYNAMITE GUN CRUISER.

The Dynamite Gun Cruiser.

This ship is to carry three dynamite guns. These are laid parallel to each other in line of keel, and at a fixed elevation of about 15°. The vessel has been ordered of the Pneumatic Gun Company, of New

The Dynamite Gun Cruiser.

York, by the Naval Bureau, at the price of £70,000. The Gun Company has entrusted the construction of the hull to Messrs. Cramp, of Philadelphia. The principal dimensions are:—

Length on water-line . .	239 ft.
Length over all . . .	246 ft.
Extreme breadth of beam .	26 ft. 6 in.
Draft of water at load . .	8 ft. 6 in.
Displacement	715 tons.

Twin screws. Triple expansion engines.

	Tons.
Hull and outfit . . .	280
Engines, boilers, and water .	247
Dynamite guns and outfit .	123
Coal	120
	770

To be completed in 12 months from February, 1887. Indicated horse-power to be 3200. Speed with four runs to be not less than 20 knots. Trial in smooth water; coal aboard, 28 tons. Ten projectiles for each gun. Shells to contain 200 lbs. of dynamite, or other higher explosive; guns to throw them at least one mile. Each gun to be capable of being discharged at least once in two minutes. The projectiles must not tumble or break up in air, or be destroyed by impact at target before detonation of charge. Target 50 ft. by 150 ft., one statute mile distant. Half the shots must strike the target; the shots may be fired from the vessel in still water, or the guns might be mounted on shore if preferred. To have impact tubes with adjustable delayed action and effective immersion fuses adjustable for time and depth of immersion. Range must be variable down to 200 yards from muzzle of gun.

URUGUAY.

Gunboat.—General Artiga, 274 tons, 520 I.H.P., 2 12-cm. B.L.R. (30 calibres, Krupp), 2 M., launched 1883, 12·60 knots speed.

General Rivera (building), 300 tons, 1 15-cm. B.L.R., 1 6-cm. do. 12 knots speed.

Also an iron steamer of 400 tons displacement, the Malvinias, built at Elbing in 1882.

VENEZUELA.

Steamer.—Augusta, iron, launched in 1884.

TURNING POWERS OF FOREIGN ARMOURCLADS.

N.B., abbreviation, 2 s., twin screws.

AUSTRIA.

Custoza	306	yards	diameter, in	4	minutes,	44	seconds, at	11·5	knots.
Don Juan d'Austria	355	„	„	4	„	29	„ „	12·0	„
Archduke Albert	287	„	„	4	„	58	„ „	11·0	„
Ferdinand Max	563	„	„	9	„	53	„ „	11·5	„
Habsburg	1360	„	„	9	„	59	„ „	11·0	„
Kaiser	390	„	„	5	„	40	„ „	10·0	„
Kaiser Max	440	„	„	4	„	38	„ „	?13·0	„
Lissa	490	„	„	6	„	58	„ „	11·0	„
Prinz Eugen	—	„	„	4	„	30	„ „	12·0	„
Salamander	960	„	„	6	„	33	„ „	9·5	„
Tegetthoff	400	„	„	4	„	10	„ „	13·0	„
Maros	—	„	„	4	„	0	„ „	—	„
Leitha	—	„	„	4	„	0	„ „	6·0	„

BRAZIL.

Bahia, 2 s.	—	yards	diameter, in	3	minutes,	40	seconds, at	9·0	knots.
Javary, 2 s.	328	„	„	6	„	0	„ „	10·0	„
Lima Barros, 2 s.	219	„	„	4	„	0	„ „	11·0	„
Solimoes, 2 s.	—	„	„	6	„	0	„ „	10·0	„
Silvado	—	„	„	5	„	48	„ „	9·0	„
Cabral	—	„	„	3	„	20	„ „	9·5	„

CHILI.

Almirante Cochrane, 2 s.	300	yards	diameter, in	4	minutes,	20	seconds, at	11·0	knots.
Huascar	330	„	„	4	„	55	„ „	10·0	„

CHINA.

Ting-Yuen	360	yards	diameter, in	4	minutes,	30	seconds at	12·5	knots.

DENMARK.

Dannmark	600	yards diameter, in	4	minutes,	40	seconds at	7·5	knots.
Dannebrog	450	„ „	6	„	0	„ „	9·0	„
Esbern Snare	200	„ „	3	„	15	„ „	10·5	„
Gorm	350	„ „	4	„	20	„ „	11·0	„
Helgoland, 2 s.	300	„ „	3	„	30	„ „	10·0	„
Lindormen, 2 s.	450	„ „	3	„	50	„ „	11·0	„
Odin	420	„ „	4	„	30	„ „	11·5	„
Peder Skram	500	„ „	5	„	10	„ „	10·0	„
Rolf Krake	280	„ „	4	„	0	„ „	9·0	„

FRANCE.

Alma	380	yards diameter, in	6	minutes,	10	seconds, at	8·5	knots.
Atalante	350	„ „	4	„	40	„ „	8·0	„
Bayard	305	„ „	4	„	15	„ „	12·5	„
Bélier, 2 s.	320	„ „	4	„	50	„ „	12·0	„
Belliqueuse	—	„ „	6	„	0	„ „	12·0	„
Bouledogue, 2 s.	310	„ „	4	„	22	„ „	12·0	„
Cerbère, 2 s.	408	„ „	4	„	42	„ „	10·5	„
Colbert	500	„ „	5	„	26	„ „	13·0	„
Dévastation	410	„ „	5	„	15	„ „	12·0	„
Friedland	540	„ „	6	„	0	„ „	11·5	„
Jeanne d'Arc	—	„ „	6	„	40	„ „	10·5	„
La Galissonnière, 2 s.	522	„ „	5	„	45	„ „	12·0	„
Marengo	640	„ „	5	„	12	„ „	12·5	„
Montcalm	344	„ „	6	„	24	„ „	9·0	„
Océan	540	„ „	5	„	20	„ „	12·0	„
Onondaga, 2 s.	260	„ „	6	„	30	„ „	6·0	„
Provence	518	„ „	5	„	20	„ „	11·5	„
Richelieu, 2 s.	512	„ „	6	„	24	„ „	12·0	„
Reine Blanche	—	„ „	6	„	20	„ „	9·0	„
Suffren	588	„ „	5	„	58	„ „	13·5	„
Taureau, 2 s.	145	„ „	4	„	0	„ „	—	„
Tempête	355	„ „	3	„	30	„ „	12·5	„
Thétis	—	„ „	6	„	35	„ „	9·0	„
Tigre, 2 s.	350	„ „	4	„	30	„ „	11·0	„
Tonnerre	335	„ „	3	„	48	„ „	12·5	„
Trident	494	„ „	6	„	22	„ „	13·0	„
Triomphante	550	„ „	5	„	50	„ „	10·5	„
Victorieuse	550	„ „	5	„	30	„ „	10·5	„

GERMANY.

Arminius	400	yards diameter, in	4	minutes,	10	seconds, at	10·0	knots.
Deutschland	590	„ „	3	„	47	„ „	14.0	„
Friedrich Carl	590	„ „	6	„	0	„ „	12·0	„
Friedrich der Grosse	557	„ „	4	„	45	„ „	13·0	„
Hansa	420	„ „	4	„	0	„ „	10·5	„
Kaiser	540	„ „	3	„	6	„ „	14·0	„
König Wilhelm	720	„ „	7	„	50	„ „	13·5	„
Kronprinz	600	„ „	5	„	30	„ „	13·5	„
Preussen	530	„ „	5	„	10	„ „	13·0	„
Sachsen, 2 s.	360	„ „	3	„	40	„ „	13·0	„
Wespe, 2 s.	130	„ „	2	„	30	„ „	9·0	„

GREECE.

King George, 2 s.	—	yards diameter, in	3	minutes.	50	seconds, at	11·0	knots.
Olga	430	„ „	5	„	0	„ „	9·5	„

ITALY.

Affondatore	600	yards diameter, in	5	minutes,	0	seconds, at	13·0	knots.
Ancona	528	„ „	6	„	0	„ „	13·4	„
Castelfidardo	528	„ „	6	„	0	„ „	13·4	„
Duilio, 2 s.	220	„ „	5	„	10	„ „	—	„
Maria Pia	528	„ „	6	„	0	„ „	13·4	„
Palestro	380	„ „	5	„	43	„ „	12·0	„
Principe Amedeo	410	„ „	5	„	36	„ „	11·5	„
San Martino	528	„ „	6	„	0	„ „	13·4	„
Roma	320	„ „	5	„	58	„ „	13·0	„
Venezia	300	„ „	5	„	33	„ „	13·5	„

JAPAN.

Fu Soo, 2 s.	—	yards diameter, in	3	minutes,	30	seconds, at	?	knots.

NETHERLANDS.

Buffel, 2 s.	—	yards diameter, in	4	minutes,	0	seconds, at	11·0	knots.
Hijena, 2 s.	360	„ „	6	„	2	„ „	7·5	„
Prinz Hendrick der Nederlanden	—	„ „	4	„	35	„ „	11·0	„
Stier	—	„ „	4	„	30	„ „	11·0	„

NORWAY.

Mjölner	150	yards diameter, in	5	minutes,	30	seconds, at	7·5	knots.
Skorpionen	150	„ „	3	„	10	„ „	6·5	„
Thor	188	„ „	4	„	30	„ „	8·2	„

PORTUGAL.

Vasco de Gama, 2 s.	285	yards diameter, in	4	minutes,	0	seconds,at ?	13·5	knots.

RUSSIA.

Admiral Chichagoff	486	yards diameter, in	6	minutes,	30	seconds, at	9·0	knots.
Admiral Greig	450	„ „	6	„	30	„ „	9·5	„
Admiral Lazareff	450	„ „	6	„	50	„ „	9·5	„
Admiral Spiridoff	460	„ „	6	„	45	„ „	9·0	„
Bronenosetz	200	„ „	4	„	33	„ „	7·7	„
Czarodijka, 2 s.	390	„ „	5	„	20	„ „	7·5	„
Dimitri Donskoi,* 2 s.	—	„ „	8	„	10	„ „	11·0	„
Duke of Edinburgh	460	„ „	5	„	12	„ „	13·0	„
Edinorog	280	„ „	4	„	50	„ „	6·0	„
General Admiral	490	„ „	4	„	50	„ „	13·0	„

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* Hard-a-port helm, both engines going ahead. With the helm hard-a-port, port engine going ahead, and starboard astern, the circle was completed in 7 min. 52 sec. Helm amidships, port engine ahead, starboard astern, the time was 7 min. 7 sec. Helm hard-a-port, port engine ahead, starboard stopped, the time was 7 min. 20 sec., speed 8 to 8·5 knots. 1. Hard-a-port, port engine ahead, starboard astern, full circle, 7 min. 52 sec. 2. Helm amidships, port engine ahead, starboard astern, 7 min. 7 sec. 3. Hard-a-port, both engines ahead, speed 11 knots, 8 min. 10 sec. 4. Hard-a-port, port engine ahead, starboard stopped (8 to 8½ knots), 7 min. 20 sec. 5. 20° to starboard, both engines ahead, 13 knots, 8 min. 45 sec. 6. 25° to starboard, both engines ahead, 11 to 12½ knots, 7 min. 50 sec.

RUSSIA—*continued.*

Kniaz Pojarski	550	yards	diameter, in	7	minutes,	50	seconds,	at	10·0	knots.
Koldun	198	„	„	4	„	30	„	„	8·2	„
Kreml	512	„	„	6	„	20	„	„	7·5	„
Latnik	214	„	„	4	„	40	„	„	6·5	„
Lava	285	„	„	5	„	10	„	„	7·0	„
Minin	544	„	„	5	„	30	„	„	10·0	„
Netrond-Menya	480	„	„	5	„	40	„	„	7·5	„
Pervenetz	510	„	„	6	„	30	„	„	8·0	„
Perun	200	„	„	4	„	46	„	„	5·0	„
Petropaulowski	650	„	„	6	„	14	„	„	10·0	„
Rusalka	310	„	„	6	„	10	„	„	7·0	„
Sevastopol	880	„	„	8	„	40	„	„	10·0	„
Smertz	—	„	„	4	„	58	„	„	7·0	„
Streletz	250	„	„	5	„	0	„	„	5·5	„
Tifun	180	„	„	5	„	30	„	„	5·5	„
Uragan	175	„	„	4	„	15	„	„	7·0	„
Veshtchun	178	„	„	5	„	0	„	„	6·5	„

SPAIN.

Meñdez Nunez	600	yards	diameter, in	5	minutes,	10	seconds,	at	6·0	knots.
Numancia	610	„	„	7	„	55	„	„	12·0	„
Vitoria	544	„	„	7	„	30	„	„	12·5	„
Zaragoza	520	„	„	6	„	0	„	„	10·0	„

SWEDEN.

Garmer	145	yards	diameter, in	4	minutes,	55	seconds,	at	4·5	knots.
John Ericsson	166	„	„	6	„	40	„	„	7·0	„
Loke	180	„	„	5	„	40	„	„	8·0	„

TURKEY.

Azizieh	1000	yards	diameter, in	8	minutes,	20	seconds,	at	13·0	knots.
Assar-i-Schefket, 2 s.	384	„	„	4	„	55	„	„	10·5	„
Assar-i-Tefvik	475	„	„	4	„	30	„	„	12·5	„
Avni-Illah, 2 s.	—	„	„	6	„	0	„	„	?	„
Feth-i-Bulend	520	„	„	4	„	40	„	„	13·4	„
Hufzi-ul-Rahman	560	„	„	5	„	0	„	„	11·0	„
Idjilalieh	380	„	„	5	„	0	„	„	10·0	„
Mahmudieh	950	„	„	7	„	30	„	„	11·5	„
Messudieh	975	„	„	6	„	20	„	„	13·0	„
Muin-i-Zaffer, 2 s.	—	„	„	6	„	0	„	„	10·0	„
Mukadem-i-Haïr	500	„	„	5	„	0	„	„	12·5	„
Orkanieh	1000	„	„	8	„	0	„	„	12·0	„
Osmanieh	860	„	„	7	„	50	„	„	11·5	„

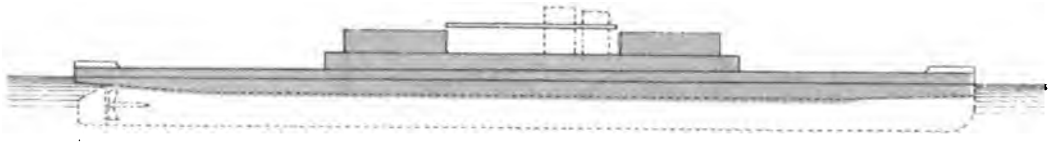
UNITED STATES.

Mahopac, 2 s.	300	yards	diameter, in	6	minutes,	36	seconds,	at	4·0	knots.
Manhattan, 2 s.	—	„	„	6	„	49	„	„	4·0	„
Passaic, 2 s.	350	„	„	5	„	0	„	„	4·5	„

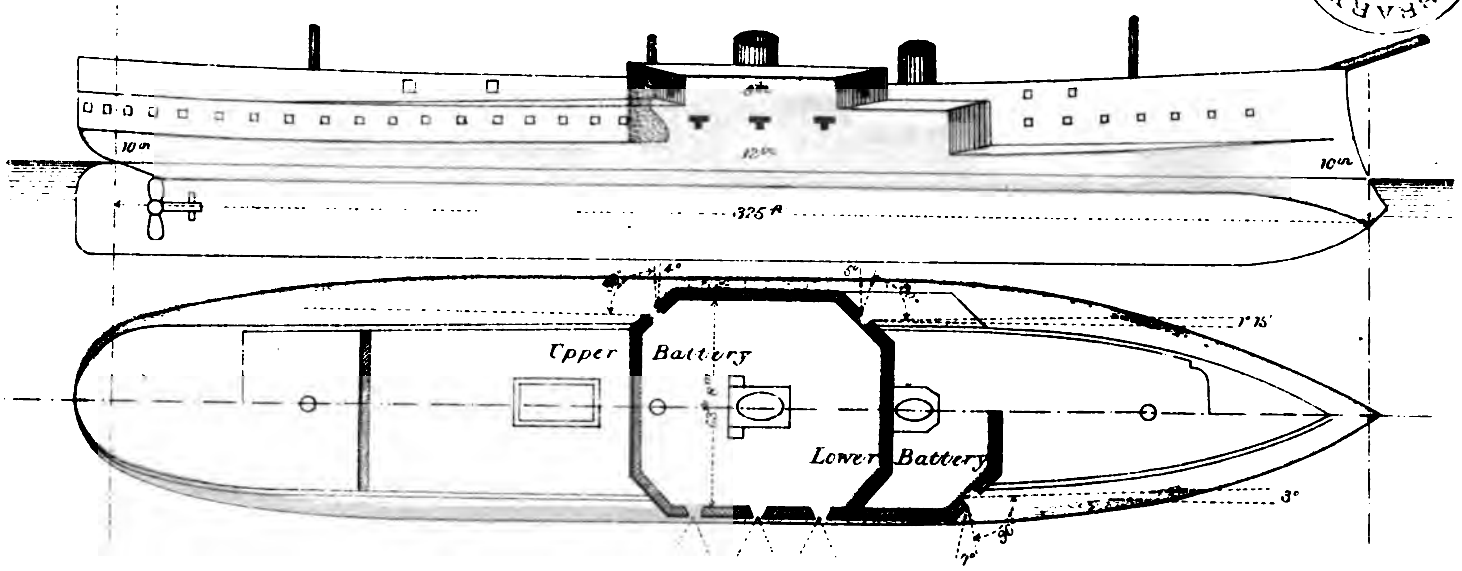
Pl. 1.

BRITISH SHIPS.

"Abyssinia." (Indian Marine)



"Alexandra."



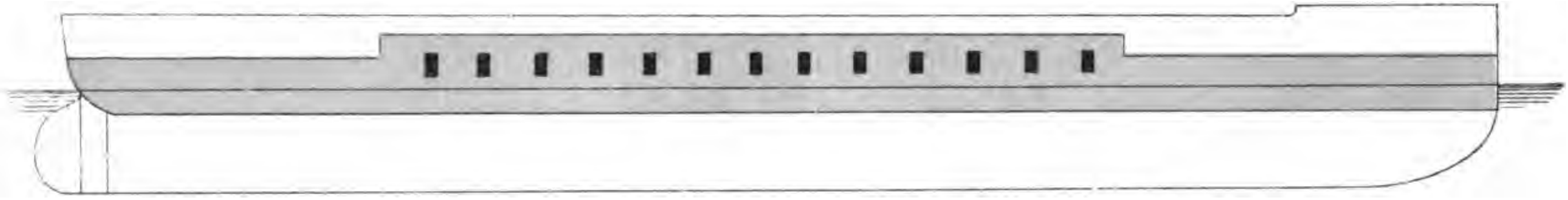
THE ASTOR LIBRARY NY

Hanhart Lith

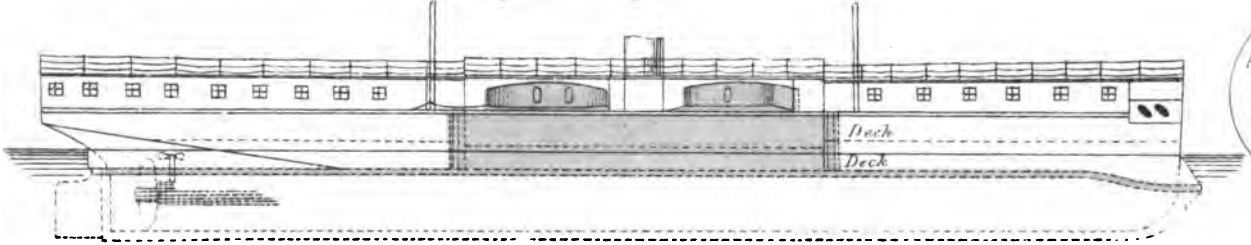
Pl. 2.

BRITISH SHIPS.

Achilles.



Ajax & Agamemnon.



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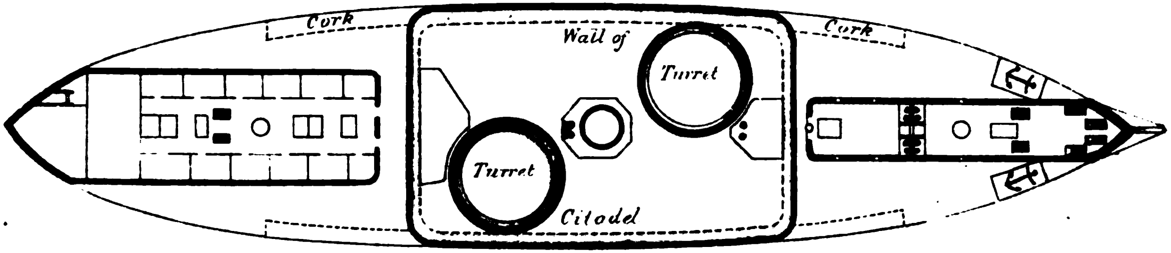
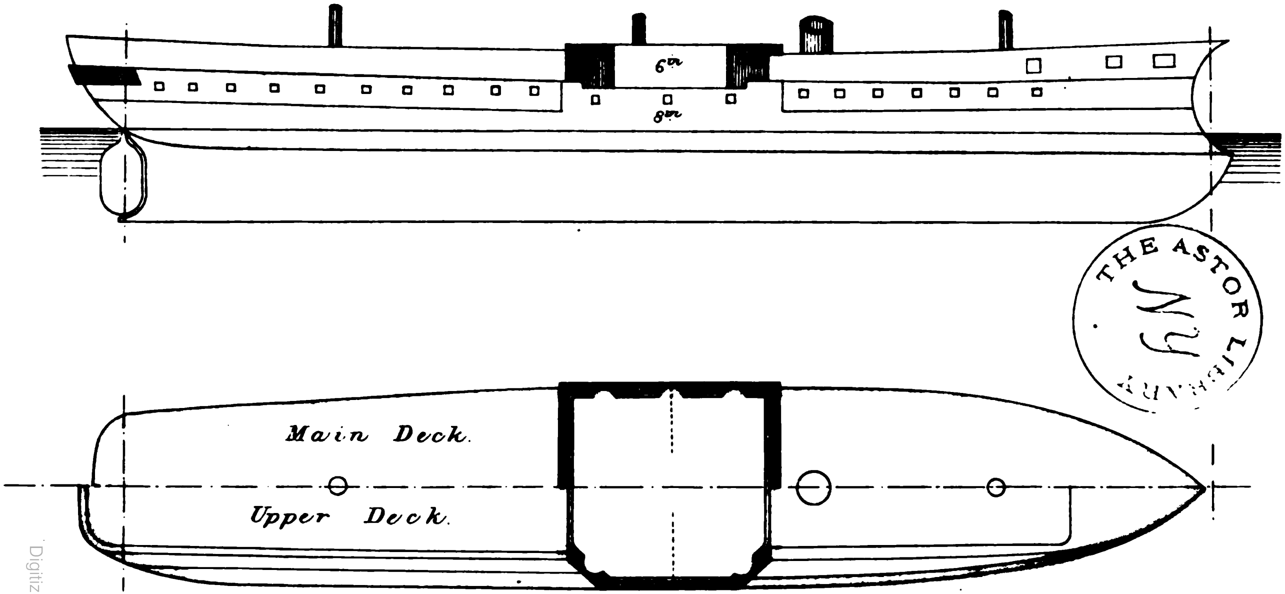
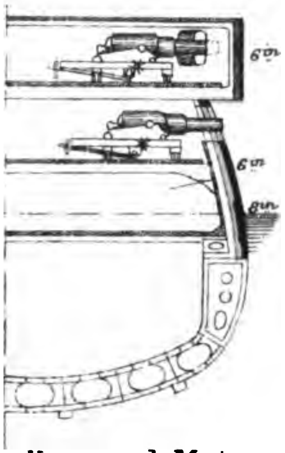


BRITISH SHIPS.

"Audacious".
Invincible
Iron Duke.



THE ASTOR LIBRARY NY



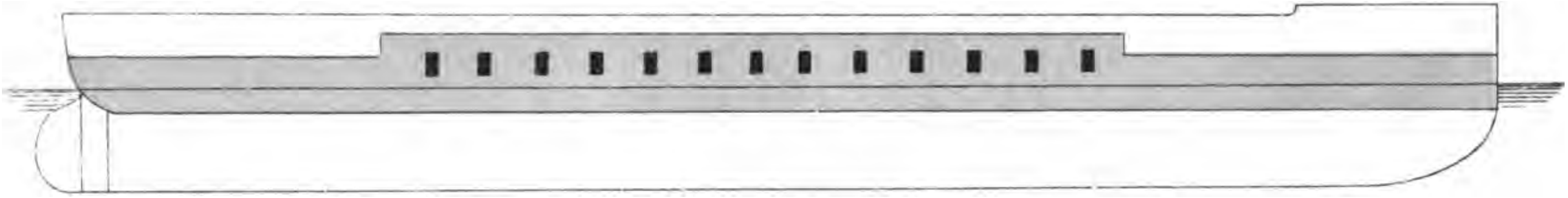
Upper and Main Batteries,
"Audacious" Class

HANHART, LITH

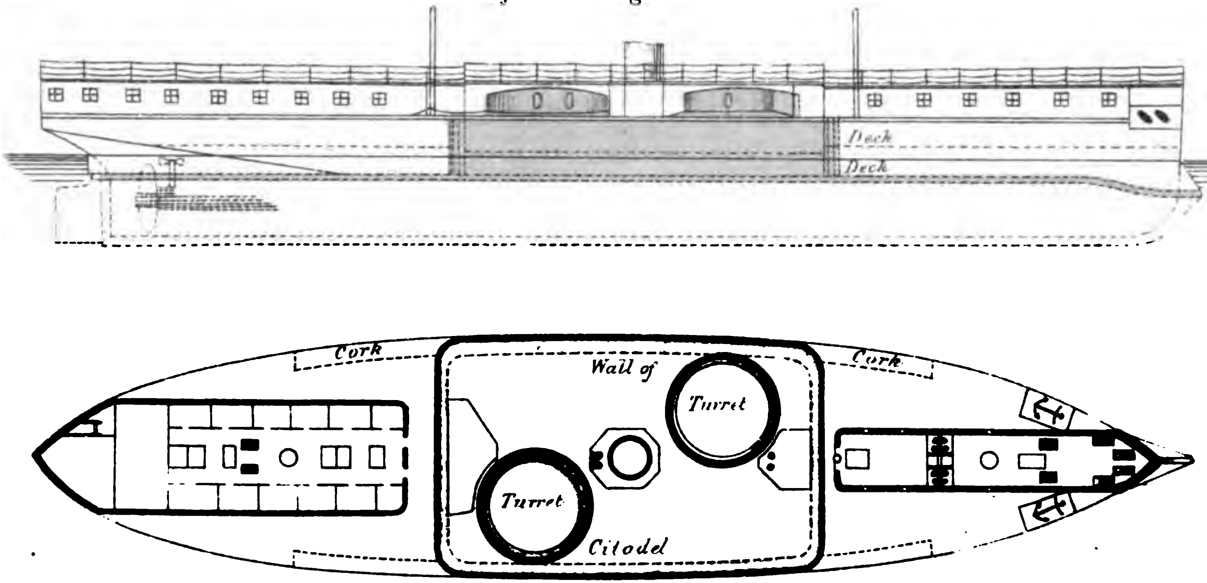
Pl. 2.

BRITISH SHIPS.

Achilles.

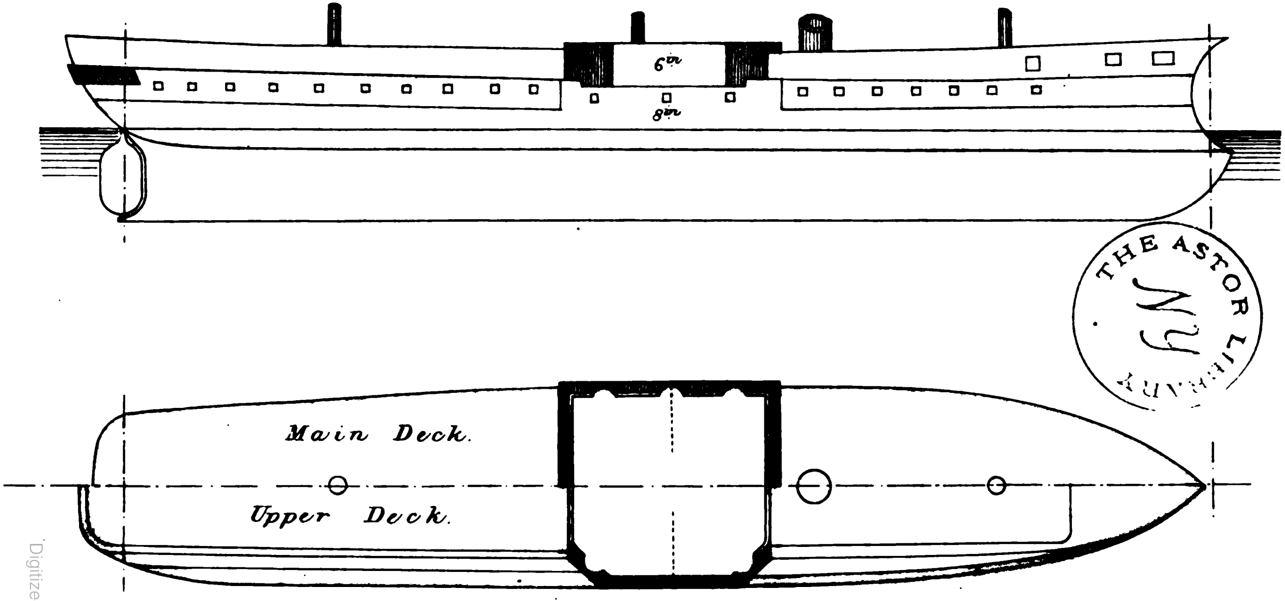


Ajax & Agamemnon.



THE ASTOR LIBRARY
NY

"Audacious".
Invincible
Iron Duke.



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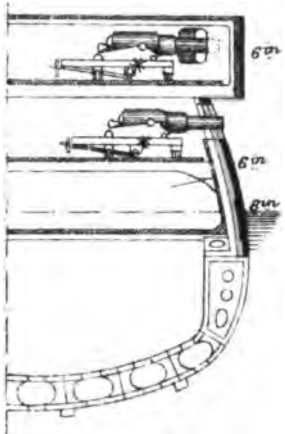
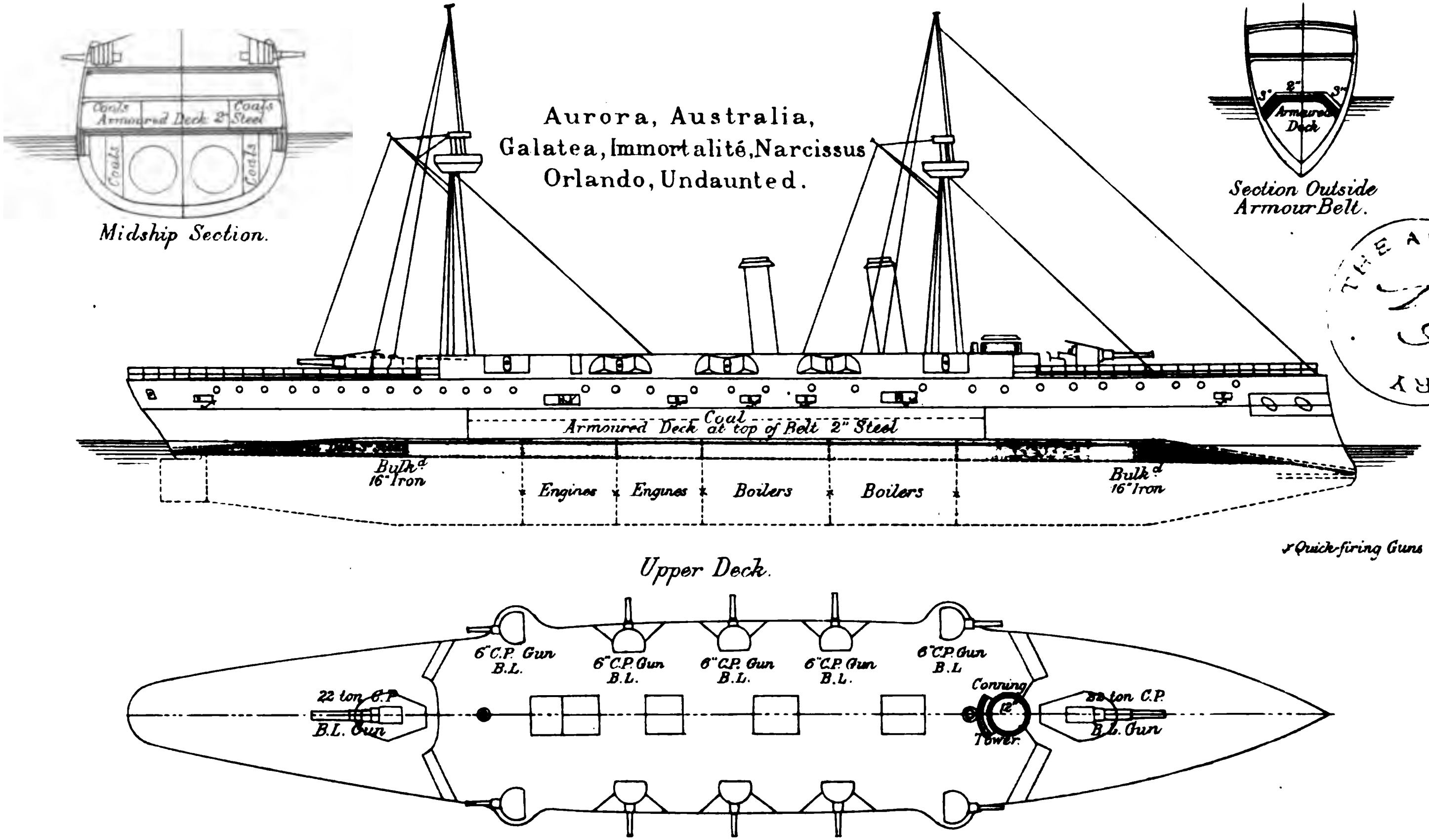


Upper and Main
Batteries,
"Audacious" Class

HANHART, LITH.

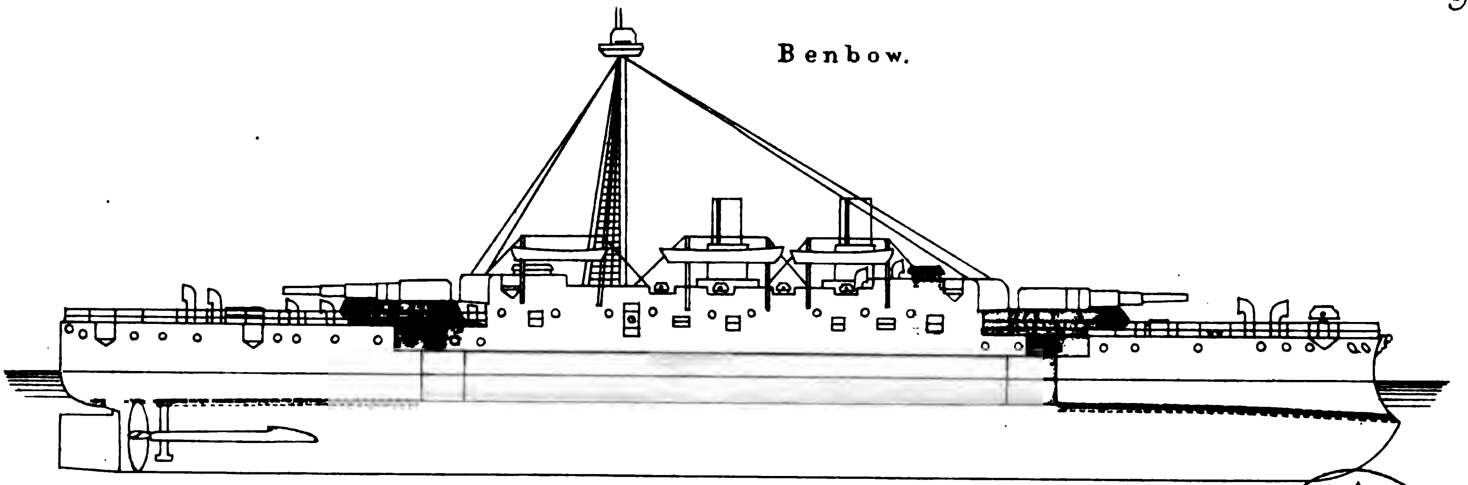
Pl. 4.

Aurora, Australia, Galatea, Immortalité, Narcissus Orlando, Undaunted.

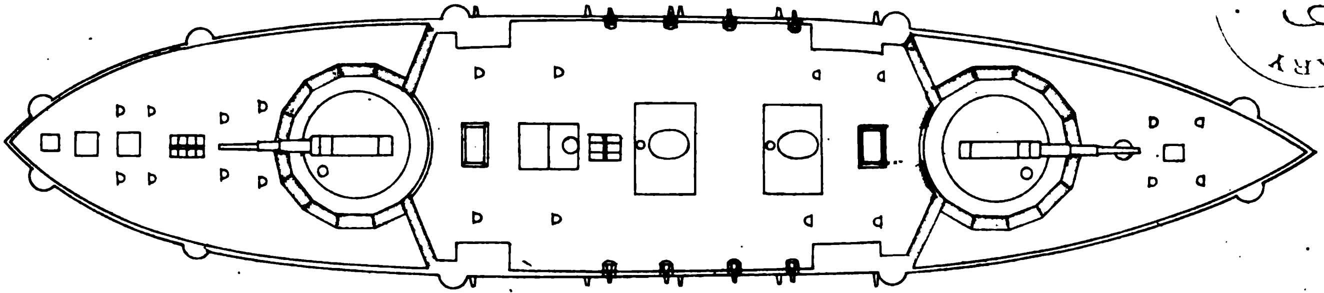


THE ASTOR LIBRARY
NY

Benbow.



Spar Deck.



THE ASTOR LIBRARY
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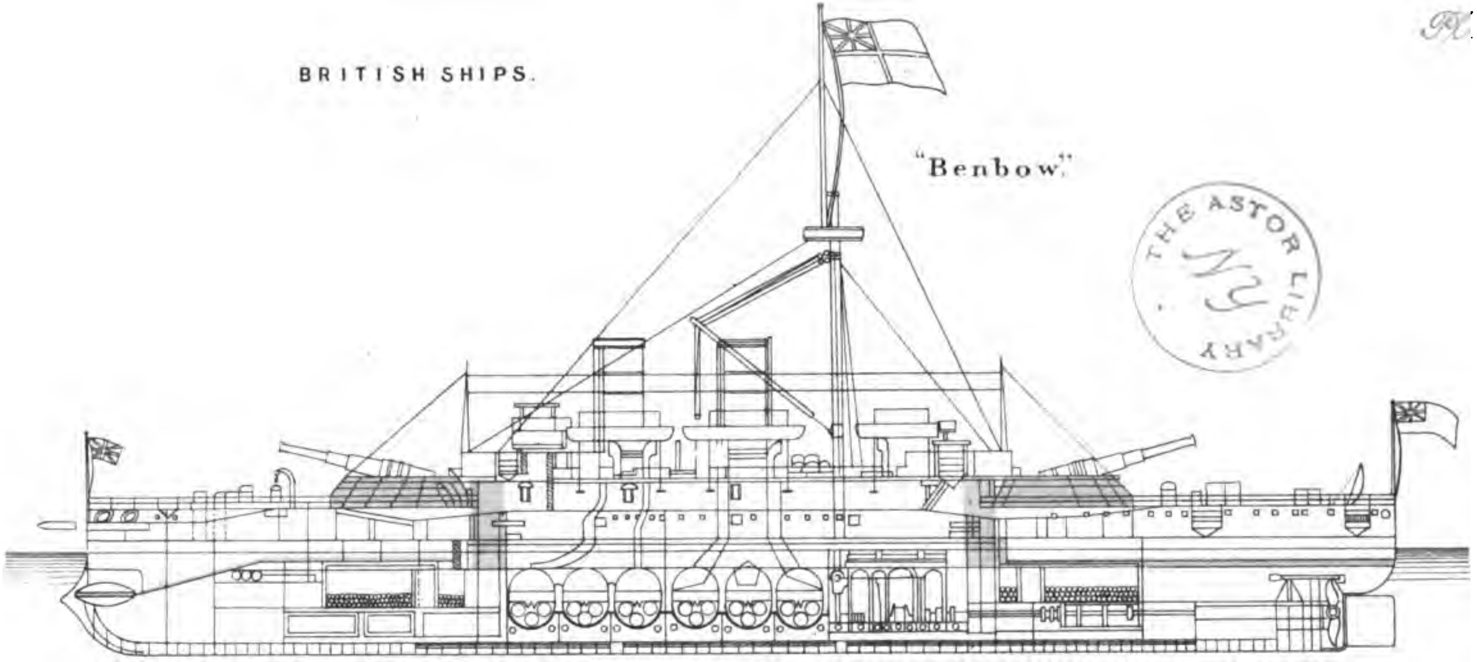
Pl. 6.

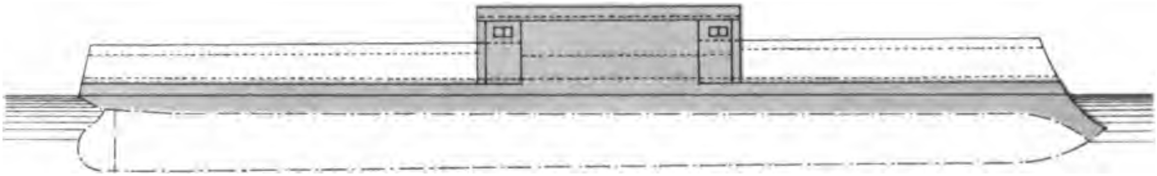
BRITISH SHIPS.

"Benbow."



THE ASTOR LIBRARY NY

"Belleisle & Orion."

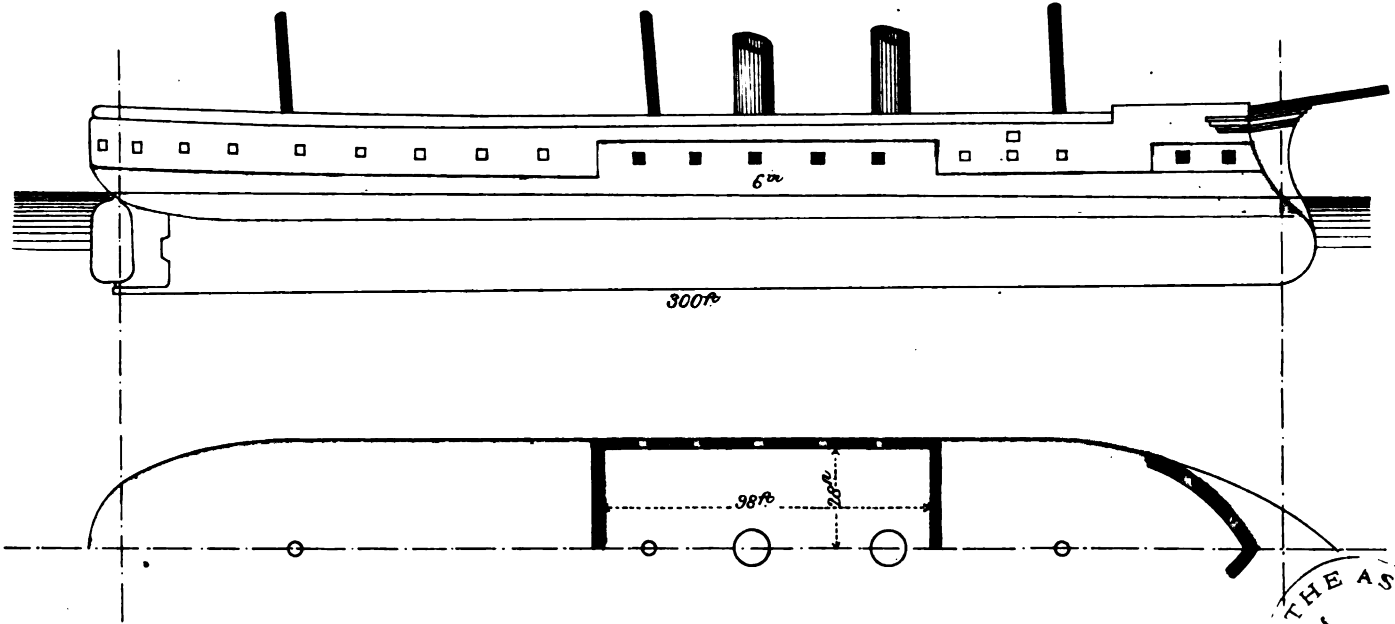


HANNHART, LITH

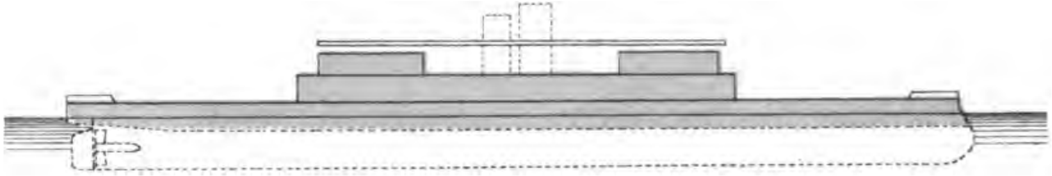
BRITISH SHIPS.

Pl. 7.

"Bellerophon."



"Cerberus" & "Magdala." (Colonial & Indian Marine respect^{ly})



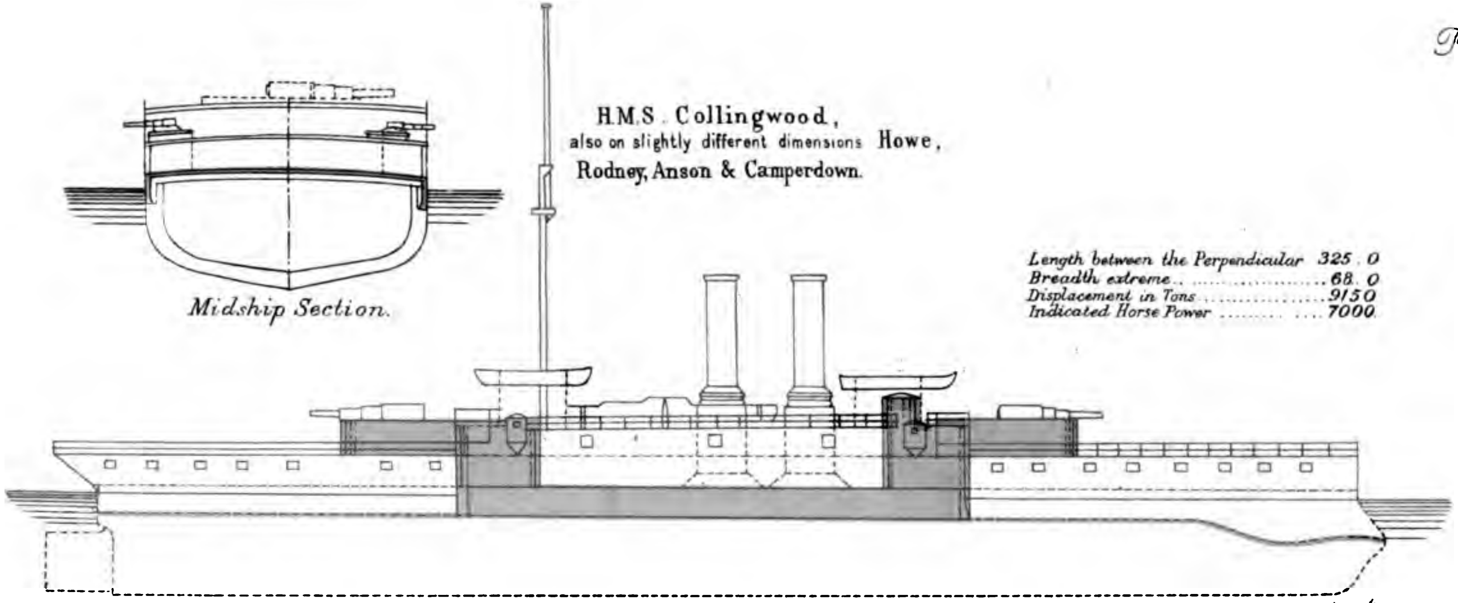
THE ASTOR LIBRARY
NY

HANNART, LITH.

Pl. 8.

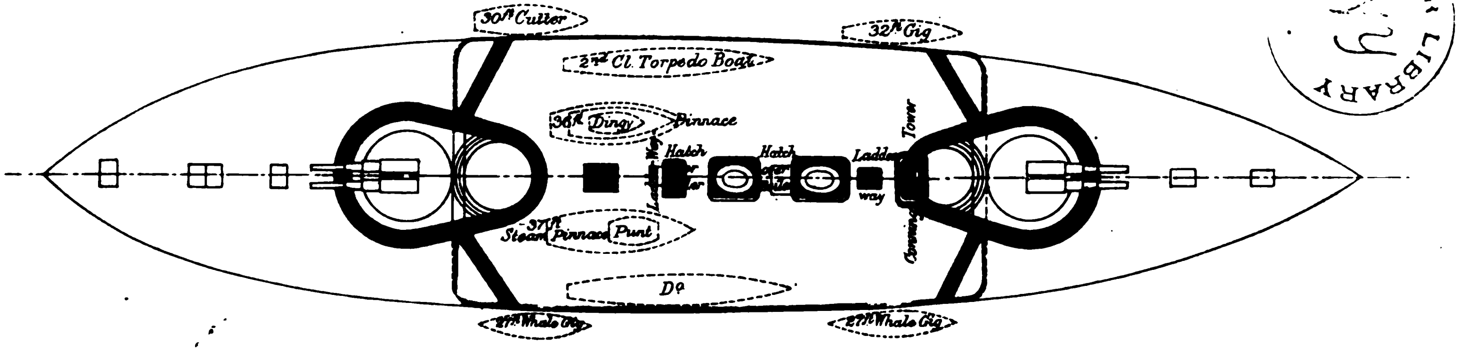
H.M.S. Collingwood,
also on slightly different dimensions Howe,
Rodney, Anson & Camperdown.

Length between the Perpendicular	325. 0
Breadth extreme	68. 0
Displacement in Tons	9150
Indicated Horse Power	7000



Midship Section.

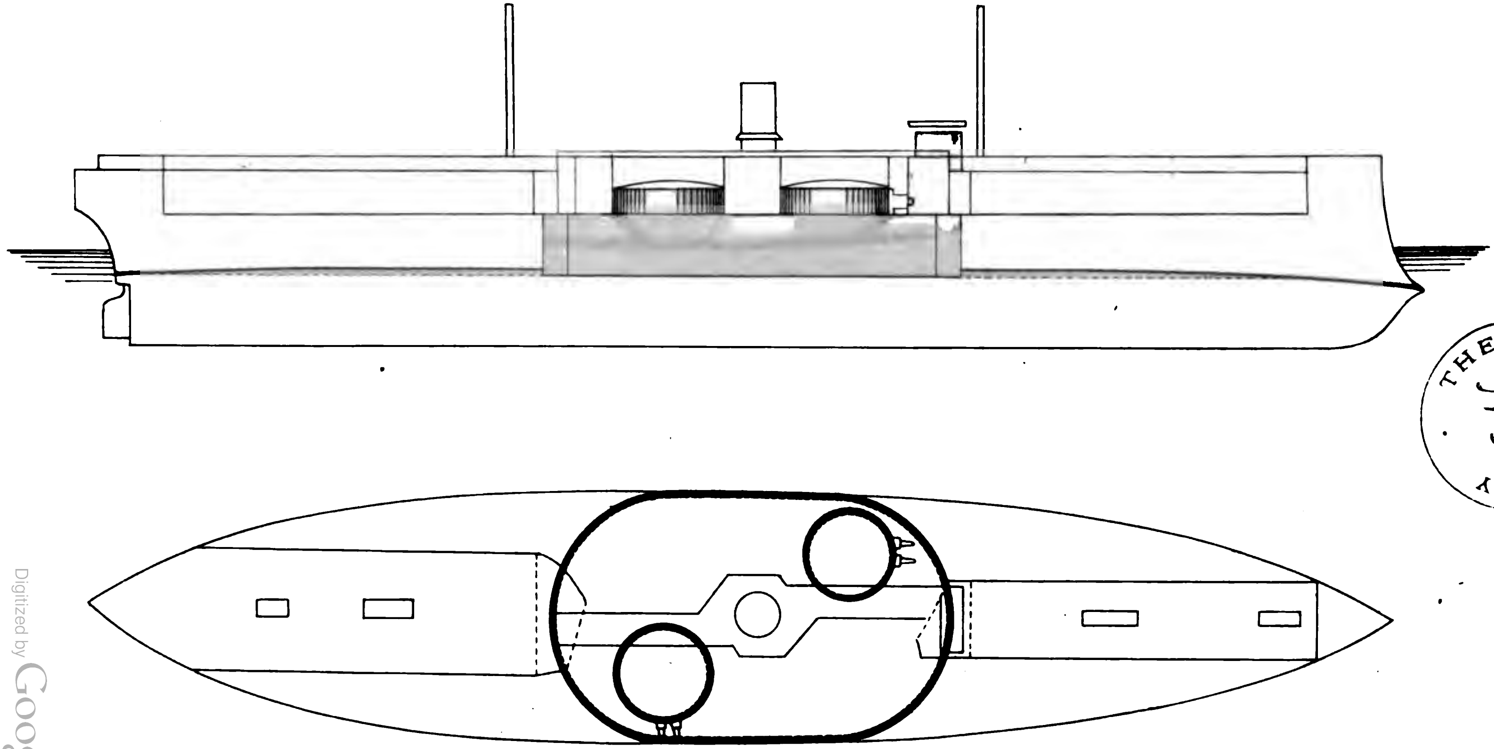
Plan of Spar & Upper Decks.



LIBRARY

Pl. 9.

Colossus & Edinburgh.

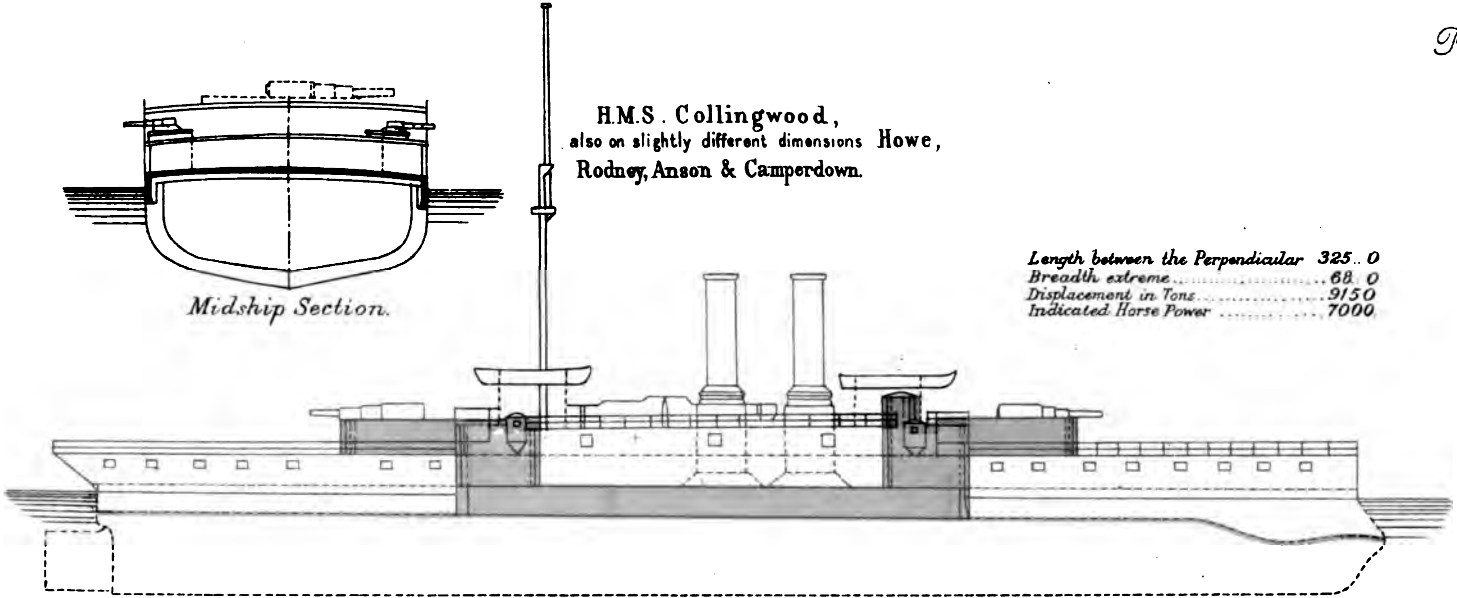


THE ASTOR LIBRARY N Y

Pl. 8.

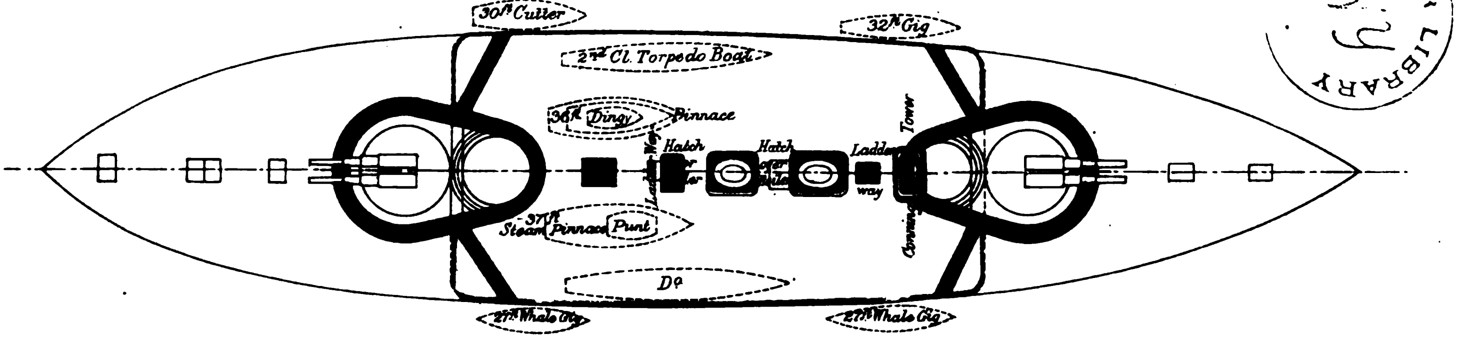
H.M.S. Collingwood,
also on slightly different dimensions Howe,
Rodney, Anson & Camperdown.

Length between the Perpendicular	325. 0
Breadth extreme	68. 0
Displacement in Tons	9150
Indicated Horse Power	7000



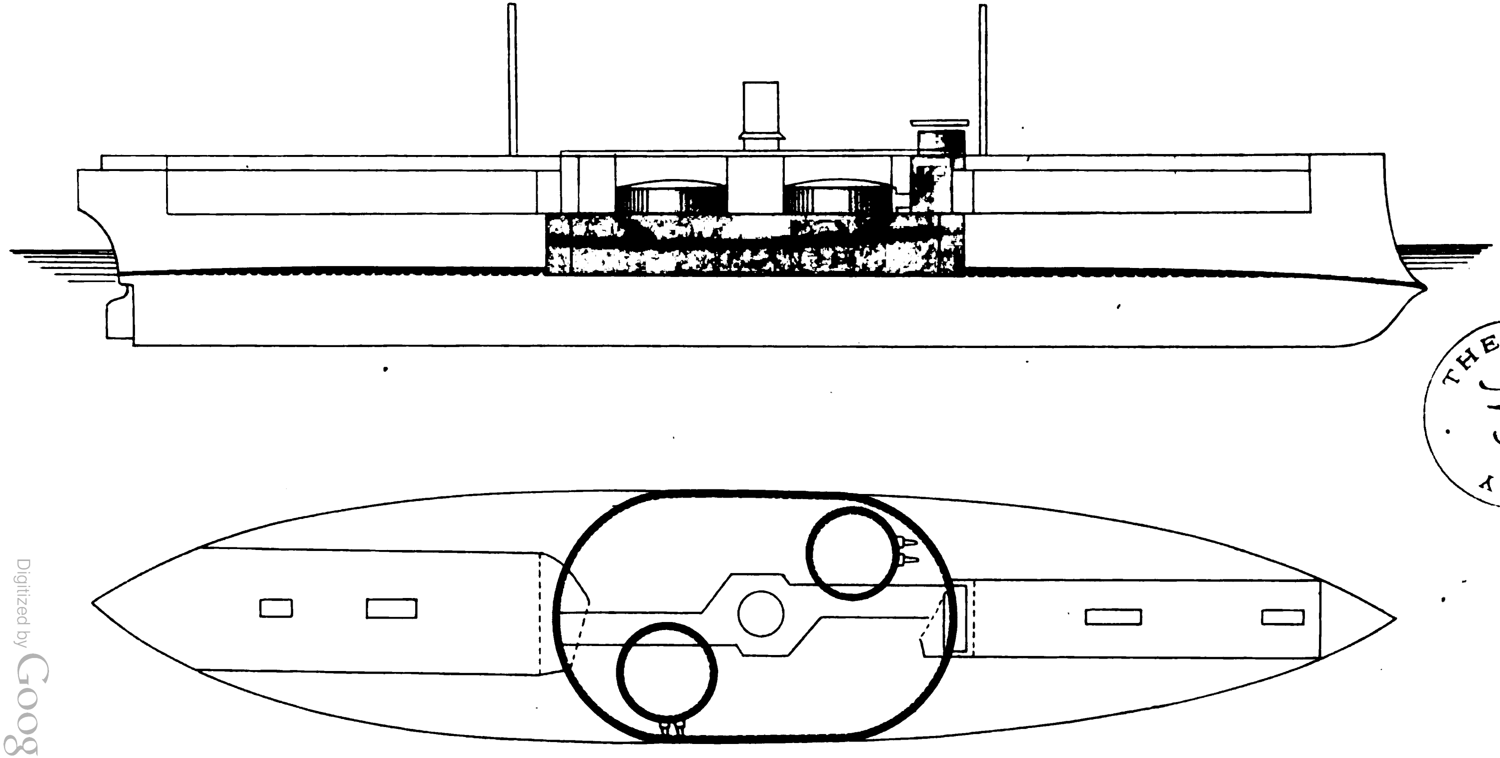
Midship Section.

Plan of Spar & Upper Decks.



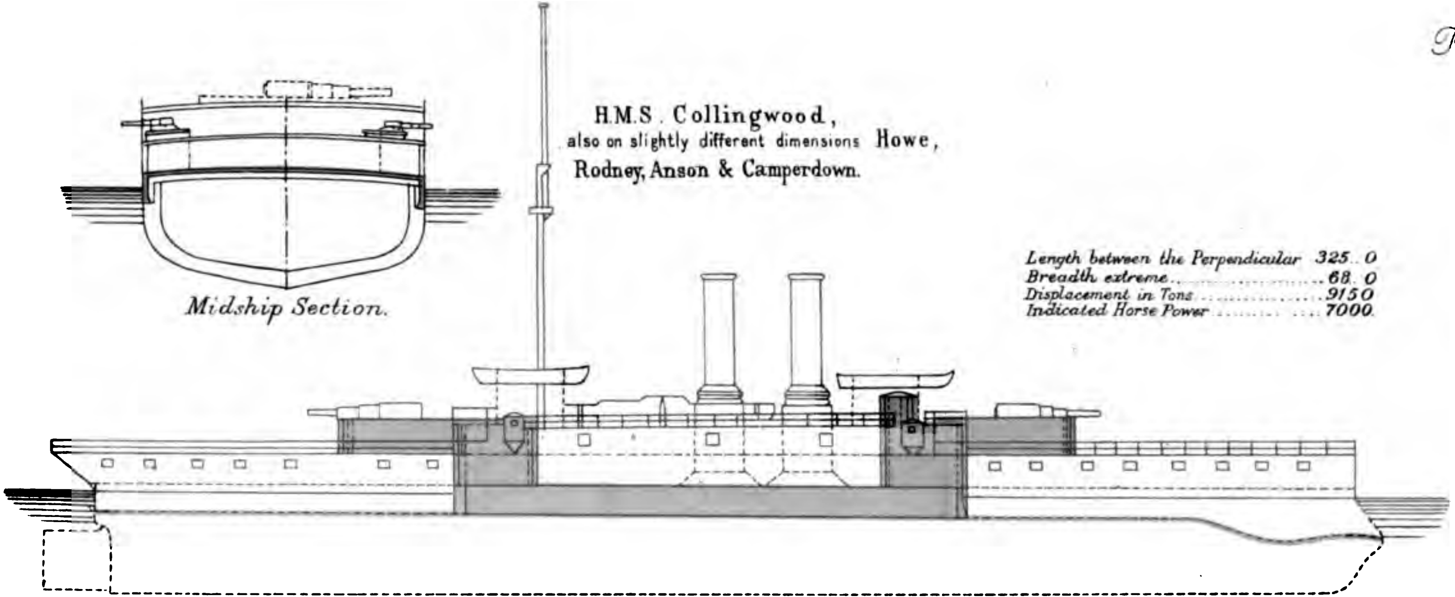
LIBRARY

Colossus & Edinburgh.



THE ASTOR LIBRARY
N.Y.

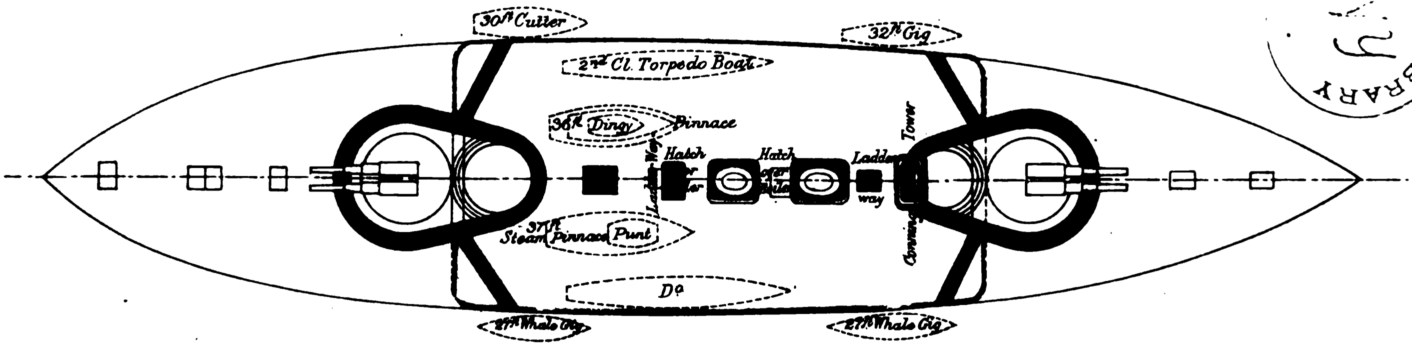
H.M.S. Collingwood,
also on slightly different dimensions Howe,
Rodney, Anson & Camperdown.



Midship Section.

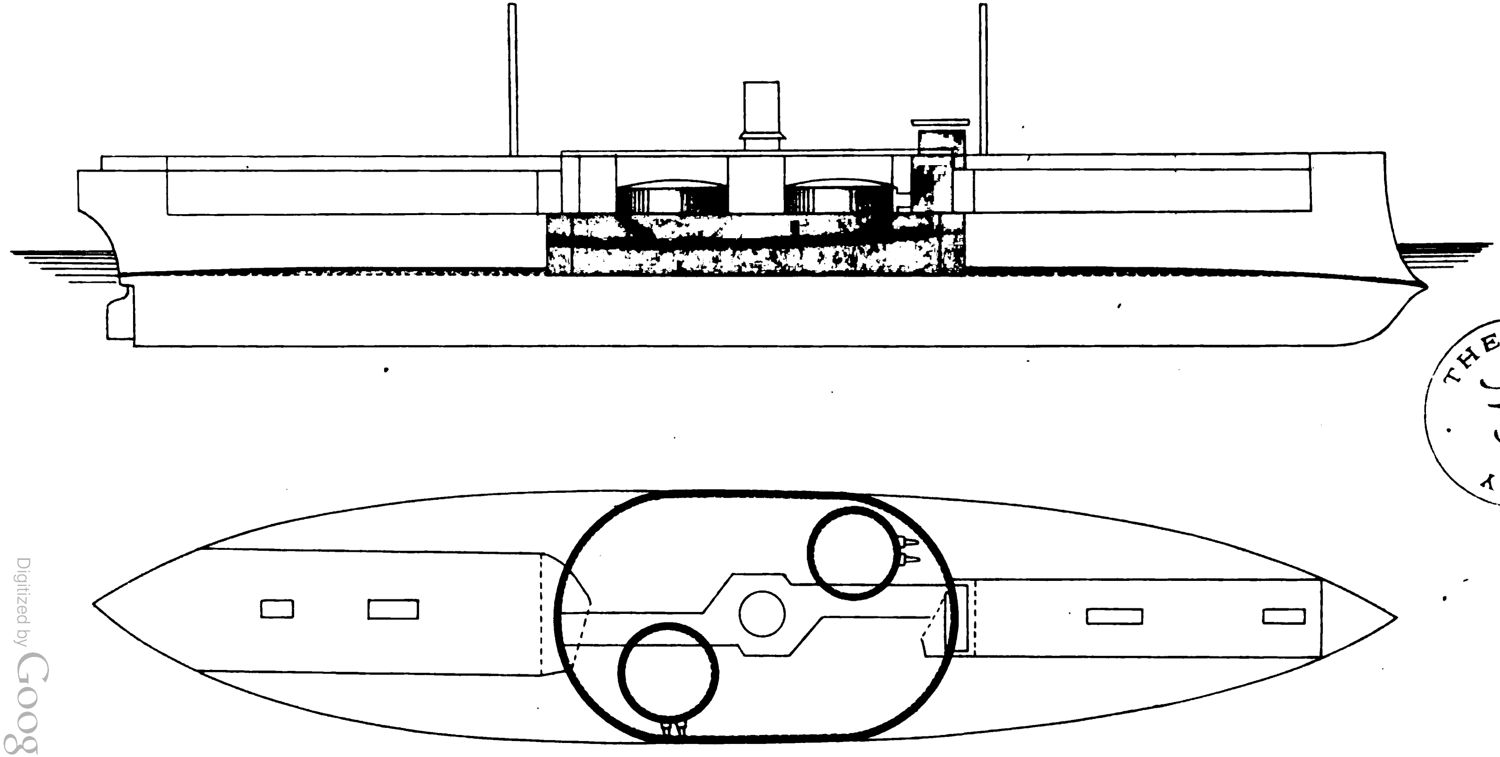
Length between the Perpendicular	325. 0
Breadth extreme	68. 0
Displacement in Tons	9150
Indicated Horse Power	7000.

Plan of Spar & Upper Decks.



LIBRARY

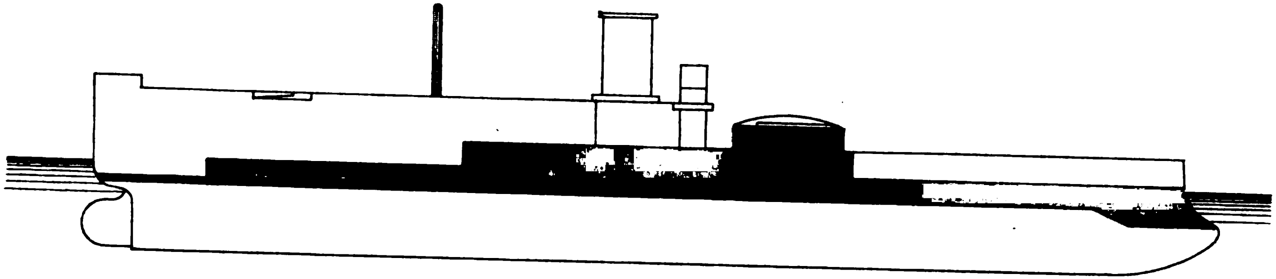
Colossus & Edinburgh.



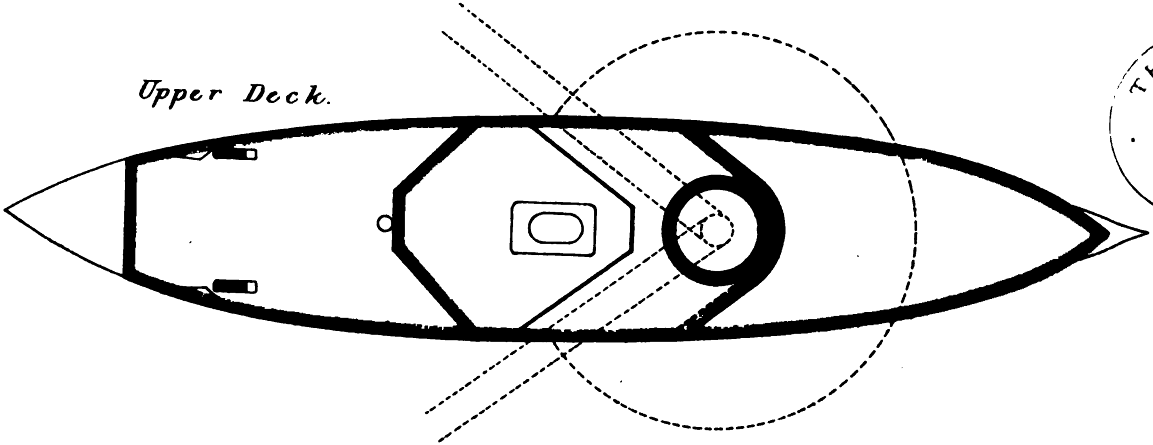
THE ASTOR LIBRARY N.Y.

BRITISH SHIPS.

"Conqueror" & "Hero".



Upper Deck.



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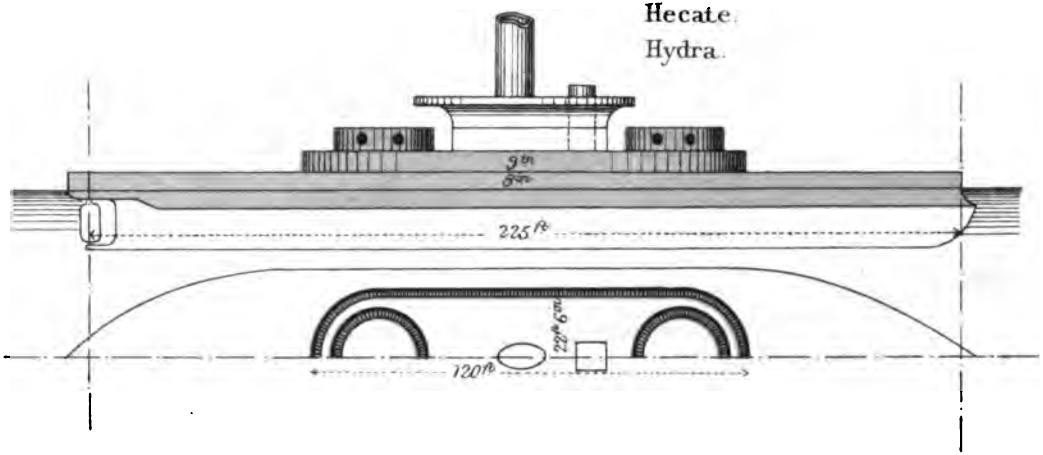
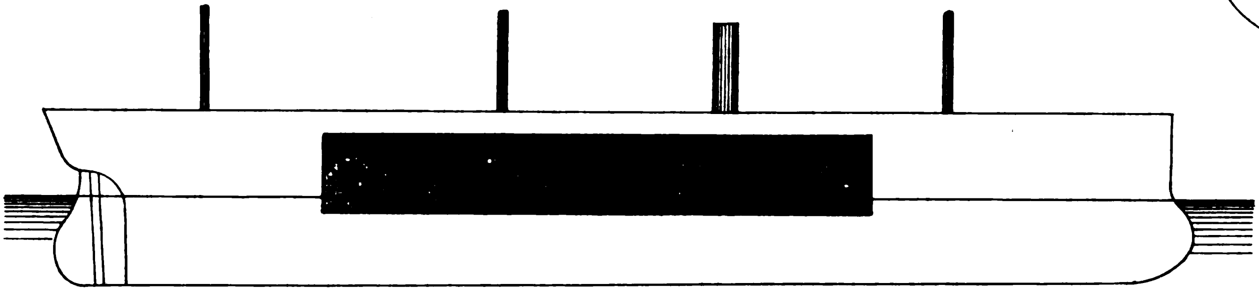
HANHART, LITH

Pl. 11.

"Cyclops." Gorgon.
Hecate.
Hydra.



"Defence."
Resistance.



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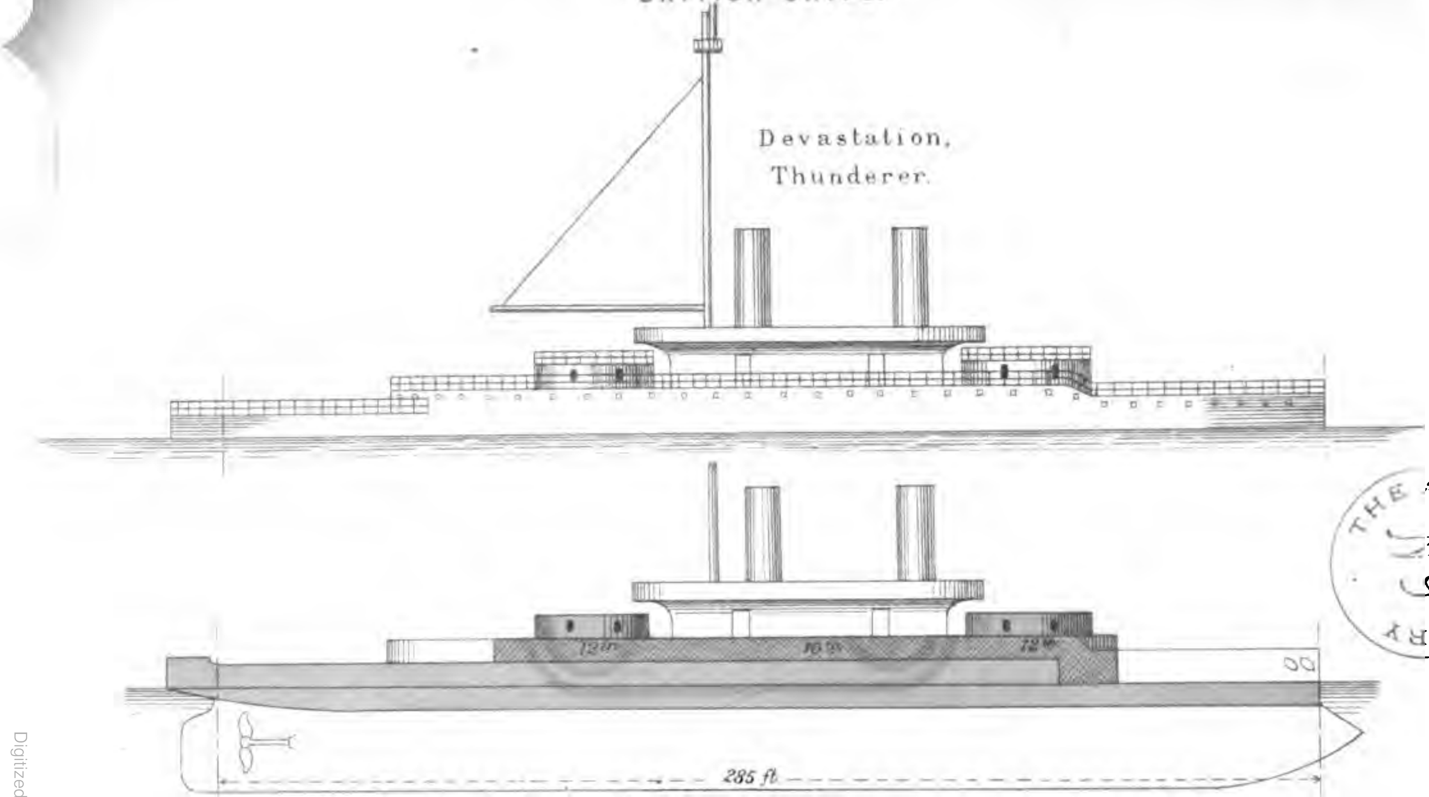
HANHART, LITH

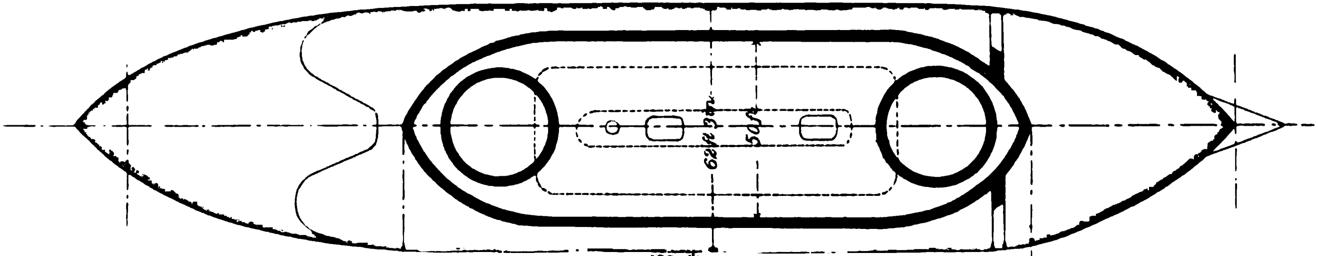
BRITISH SHIPS.

Pl. 12.

Devastation,
Thunderer.



Upper Deck.



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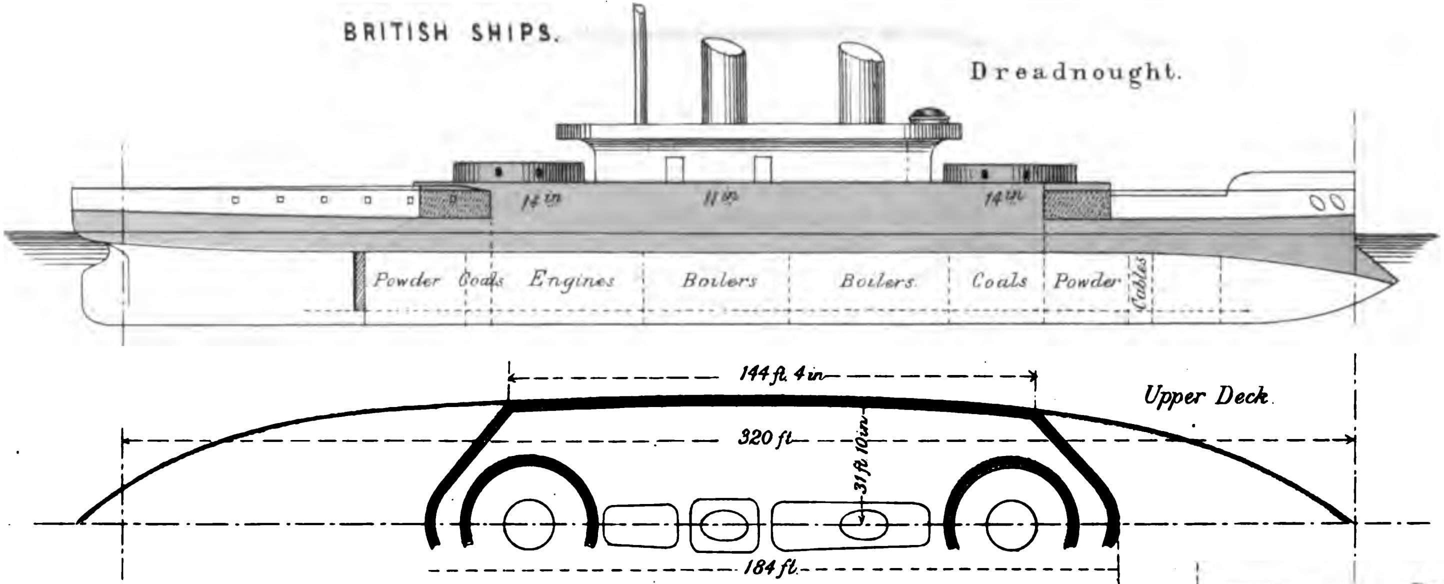
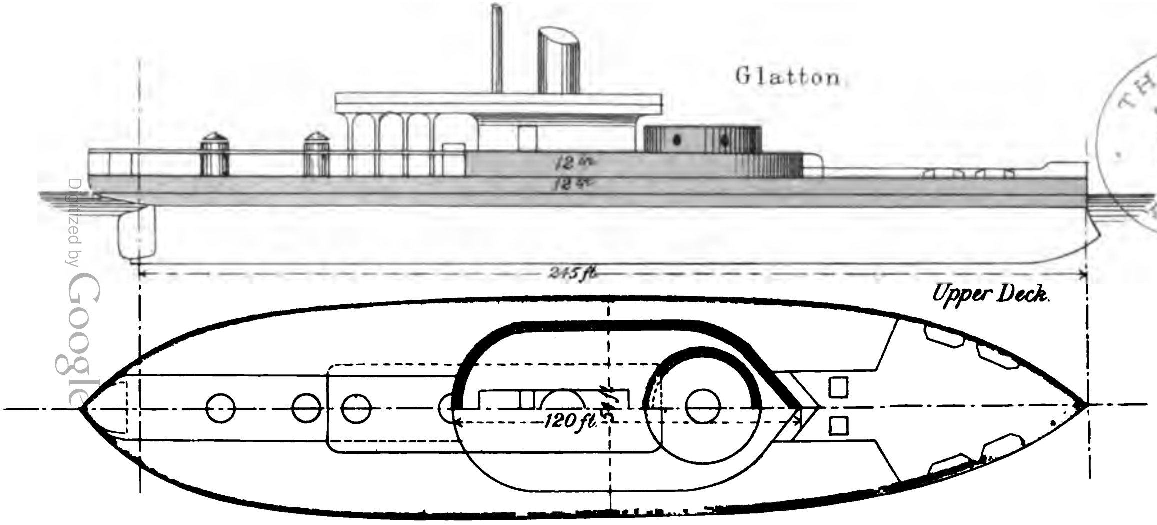
BRITISH SHIPS.

Pl. 13.

Dreadnought.

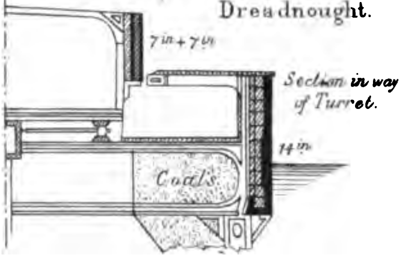


Glatton.

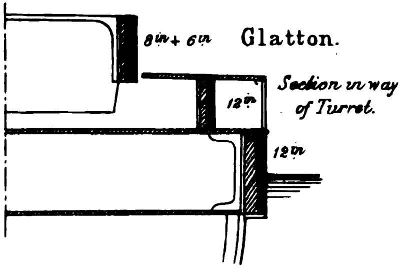


THE ASTOR LIBRARY NY

Dreadnought.



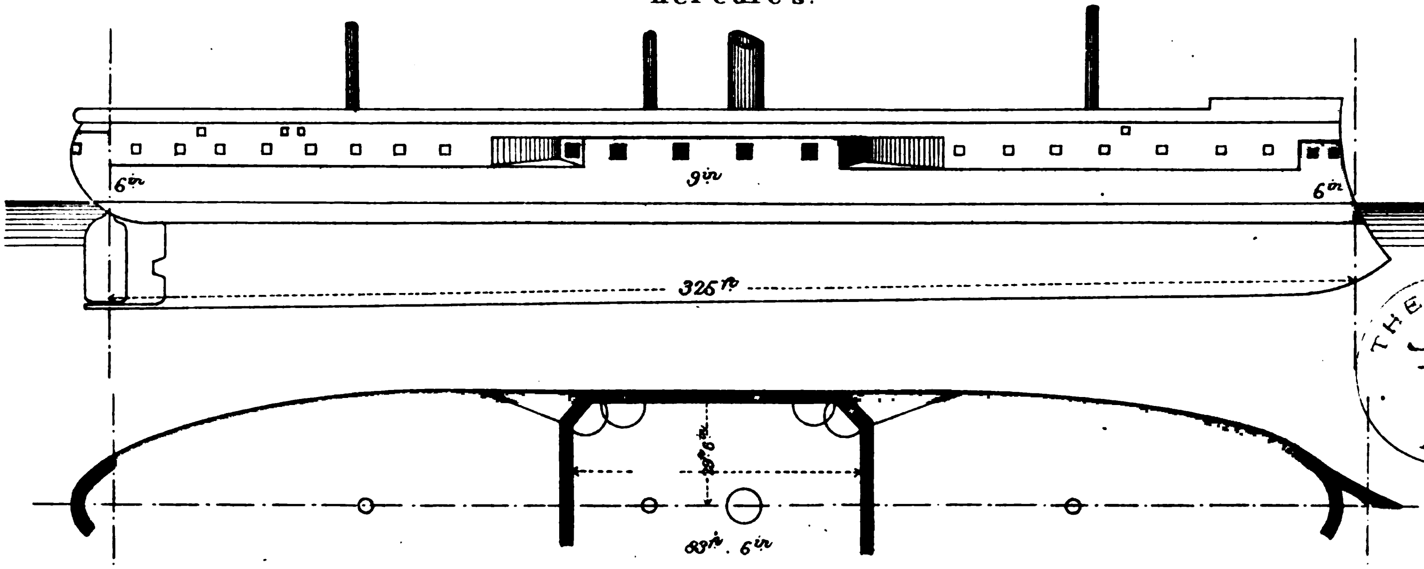
Glatton.



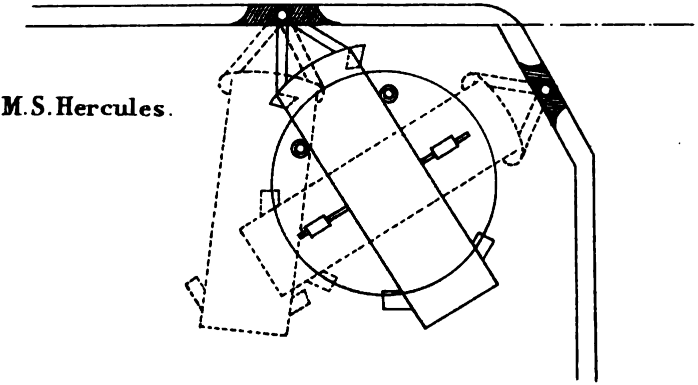
Pl. 14.

BRITISH SHIPS.

"Hercules."



THE ASTOR LIBRARY N.Y.



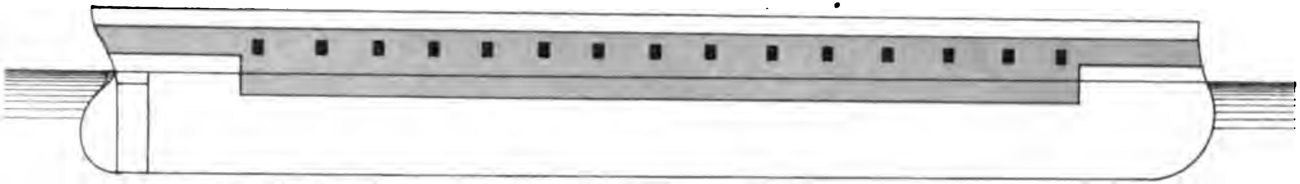
Angle Port of H.M.S. Hercules.

HANHART, LITH.

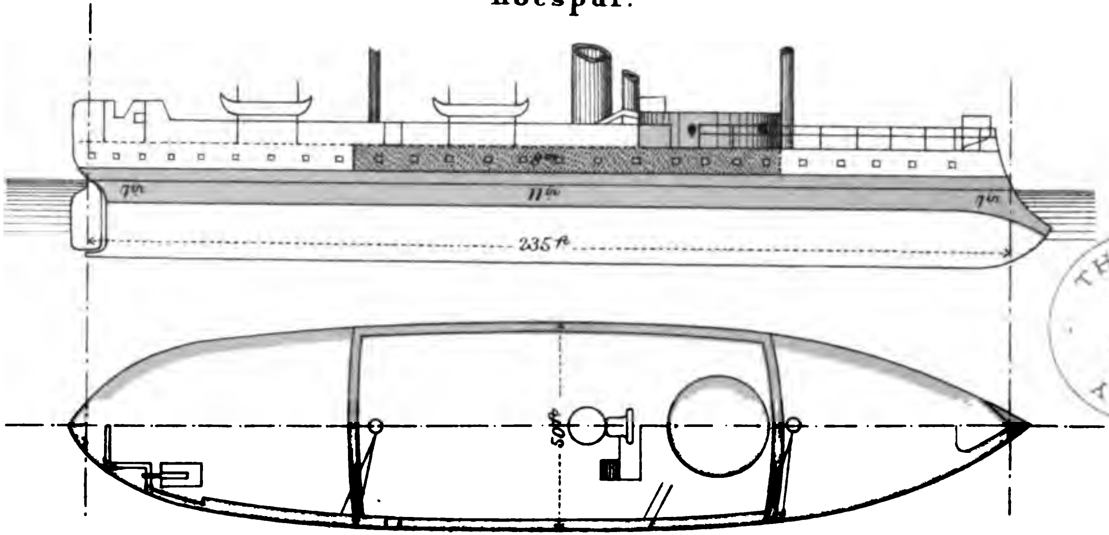
Pl. 15.

BRITISH SHIPS.

"Hector" & "Valient."



"Hotspur."



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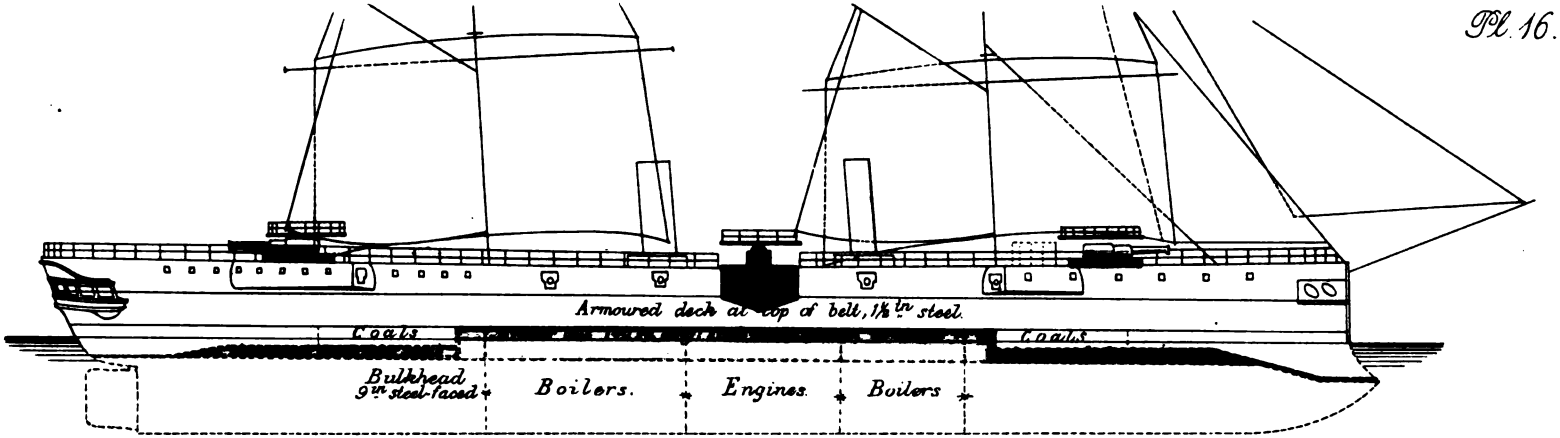
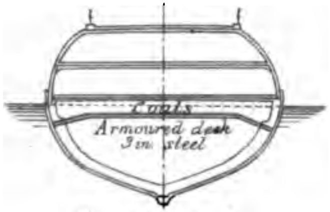
HANHART, LITH


Armoured deck at top of belt, 1½ in. steel.
Coals
Coals
Bulkhead 9 in. steel-faced
Boilers.
Engines.
Boilers.

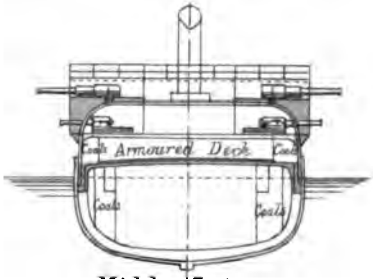


Section outside Armour belt.

Imperieuse,

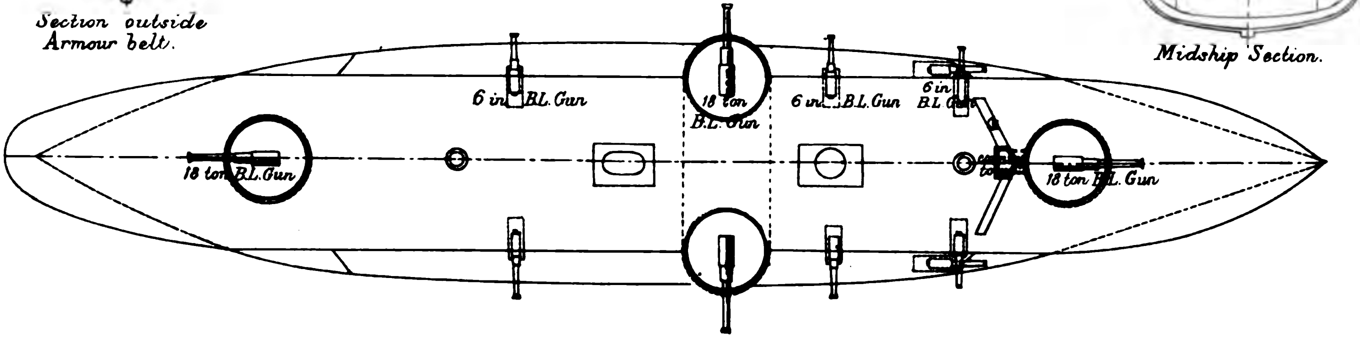
Warspite.

TH[illegible]R LIBRARY



Midship Section.

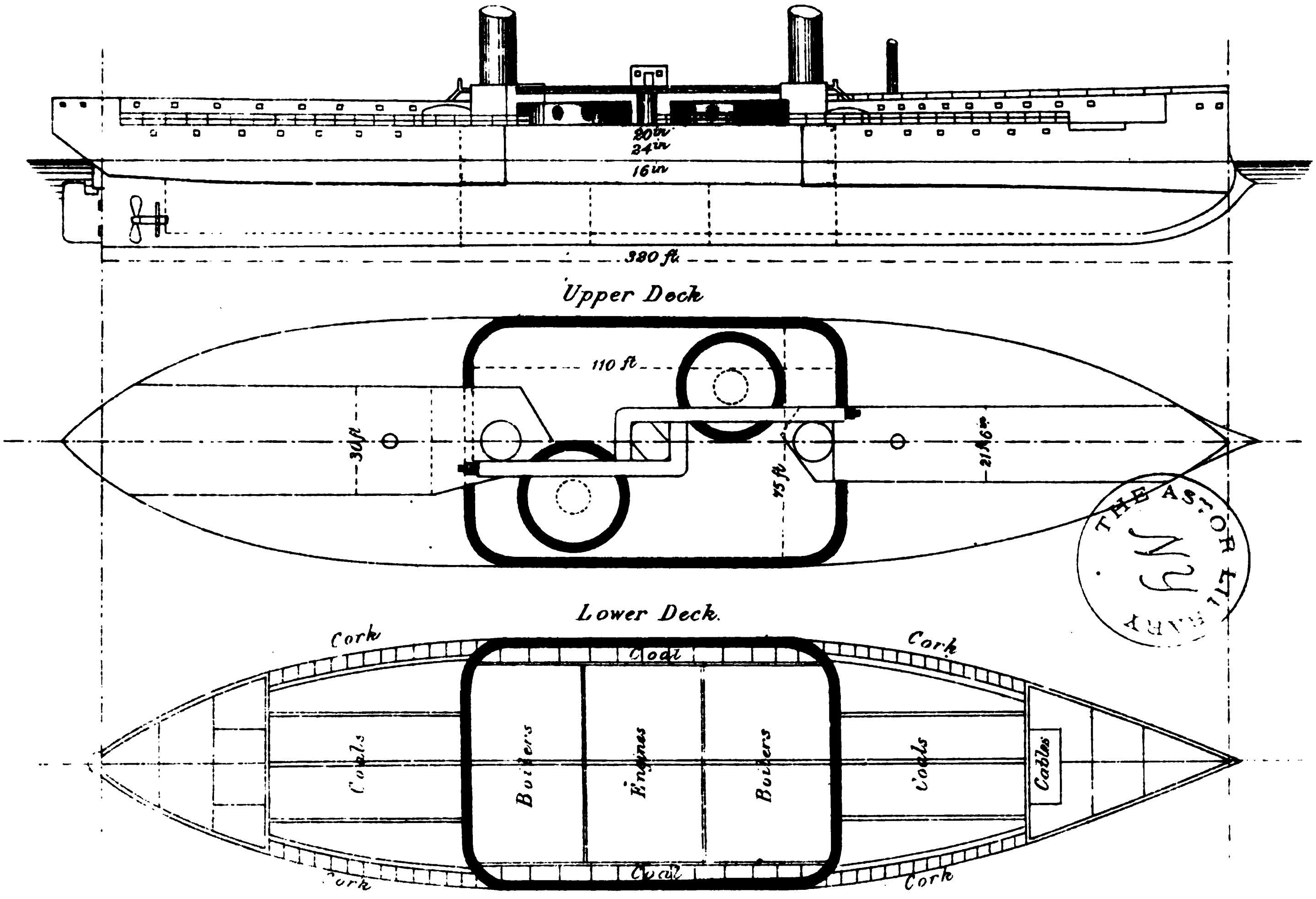
Upper Deck.



Pl. 17.

BRITISH SHIPS.

Inflexible.



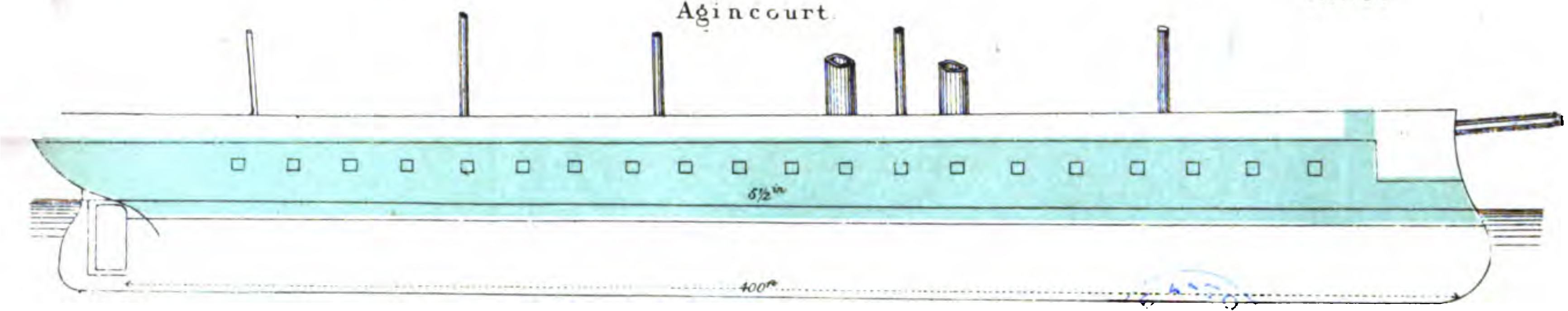
THE ASTOR LIBRARY NY

BRITISH SHIPS.

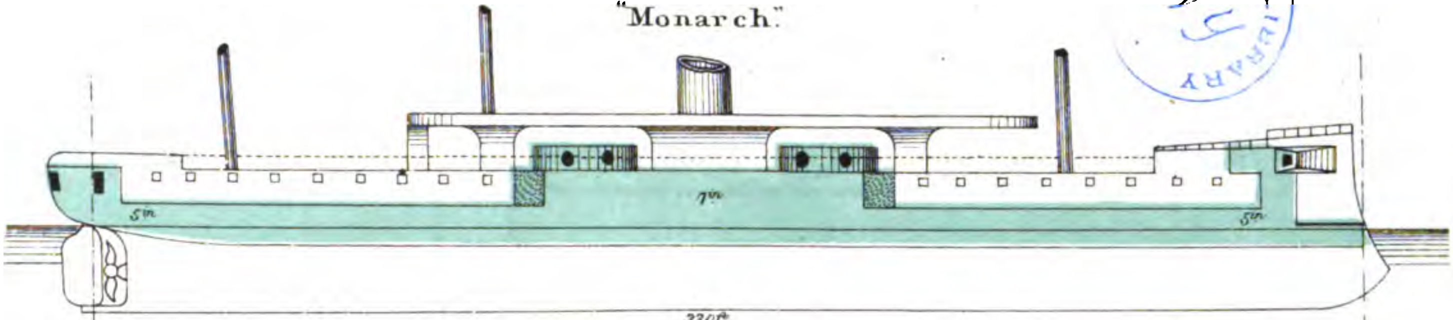
Pl. 18.

"Minotaur."

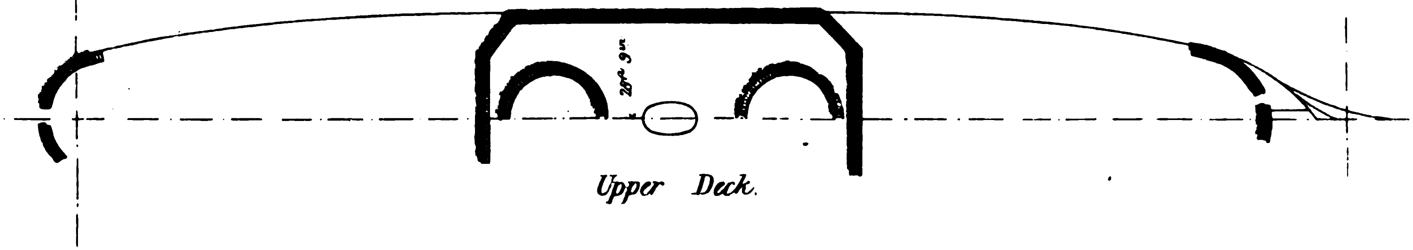
Agincourt.



"Monarch."



"Monarch."



Upper Deck.

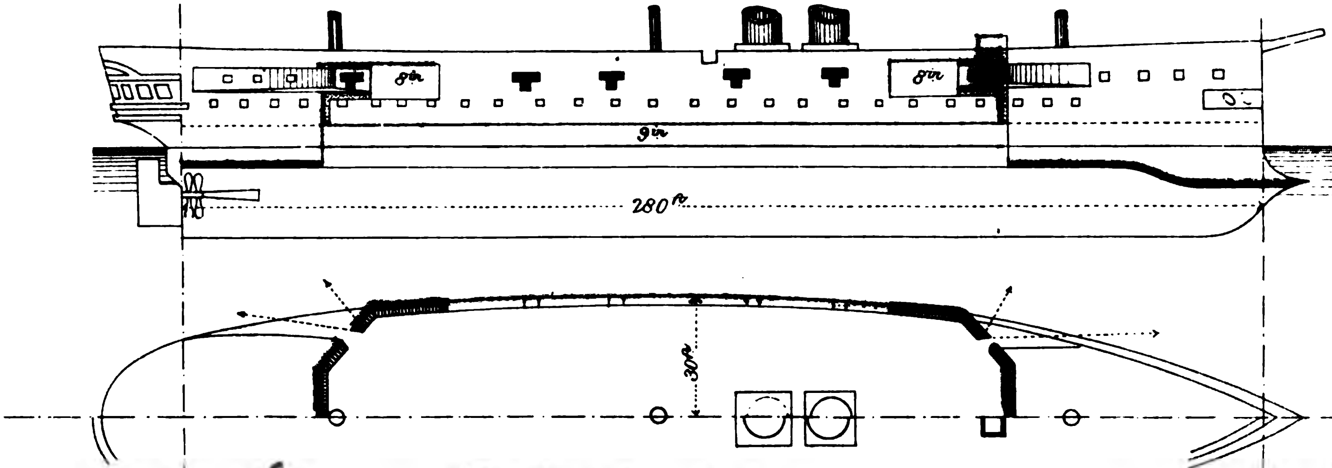
HARI ART, LITH

THE ... LIBRARY

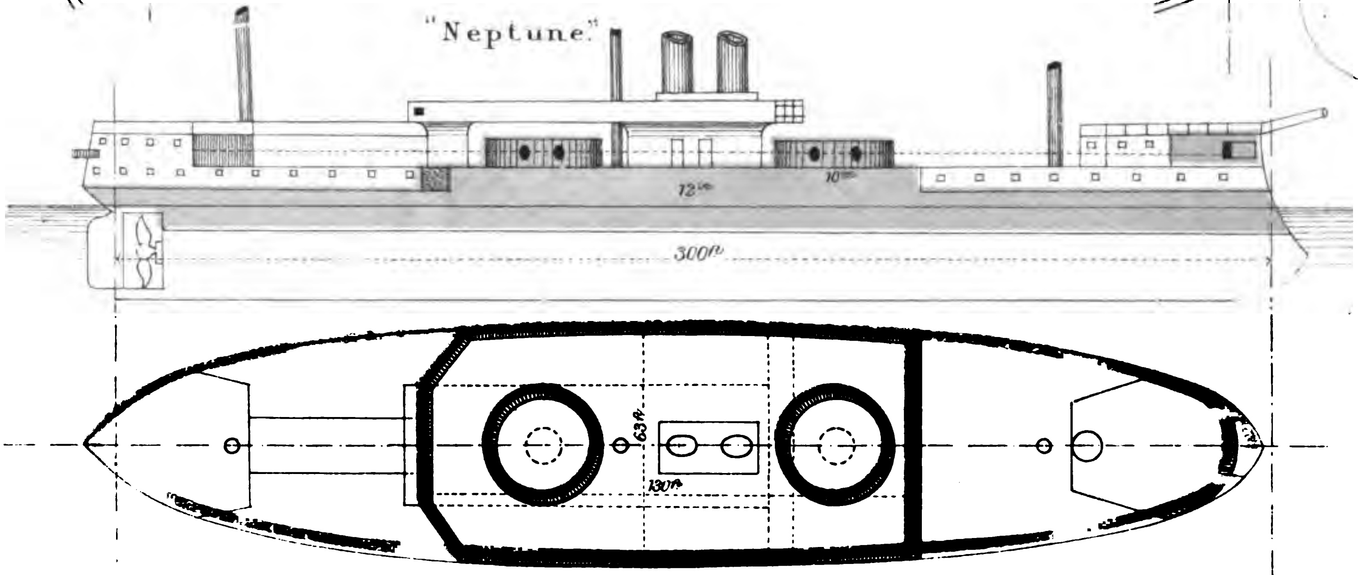
BRITISH SHIPS.

Pl. 19.

"Nelson."
Northampton.



"Neptune."



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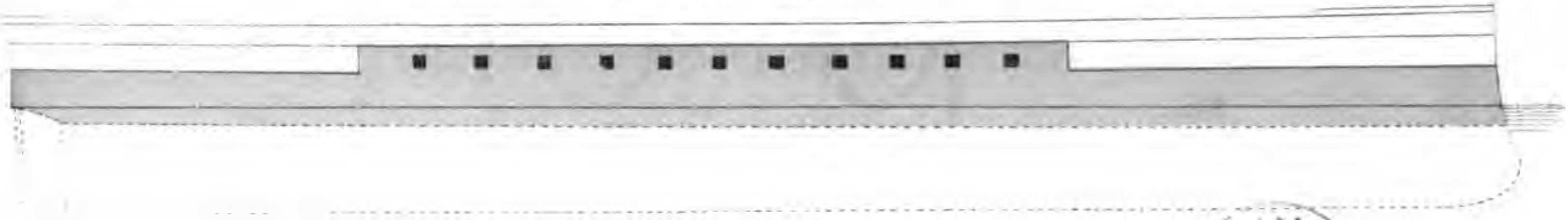
NY

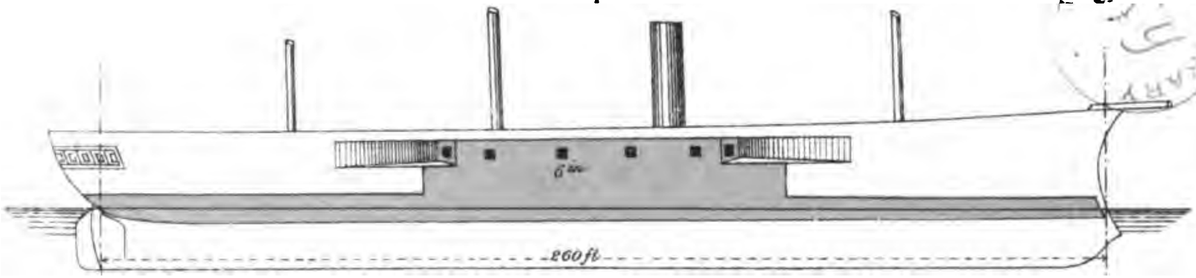
Pl. 20

BRITISH SHIPS.

Northumberland.

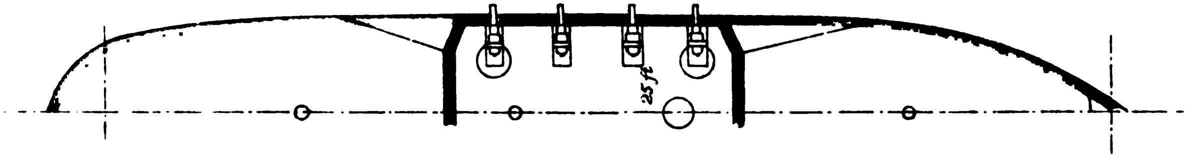


Penelope.

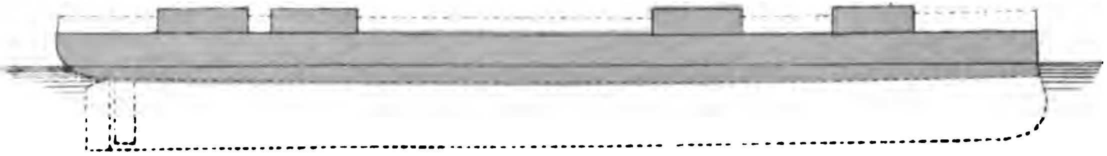


THE ASTOR LIBRARY

Main Deck.



Prince Albert.

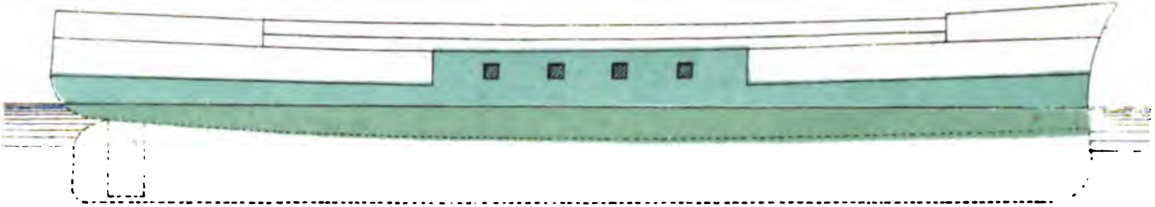


Hayhart, Lith.

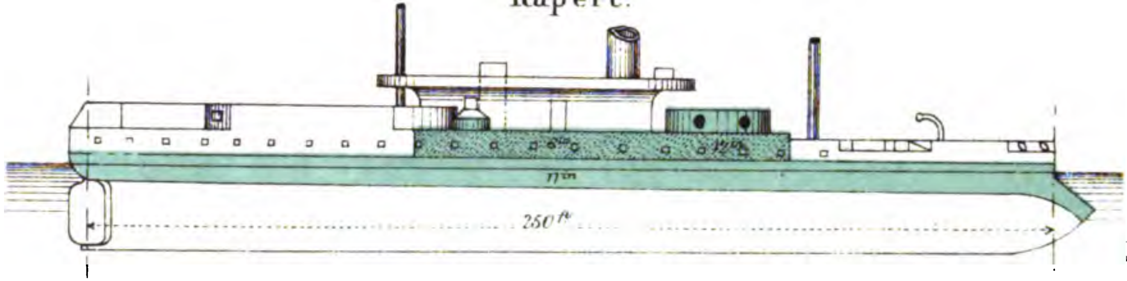
BRITISH SHIPS.

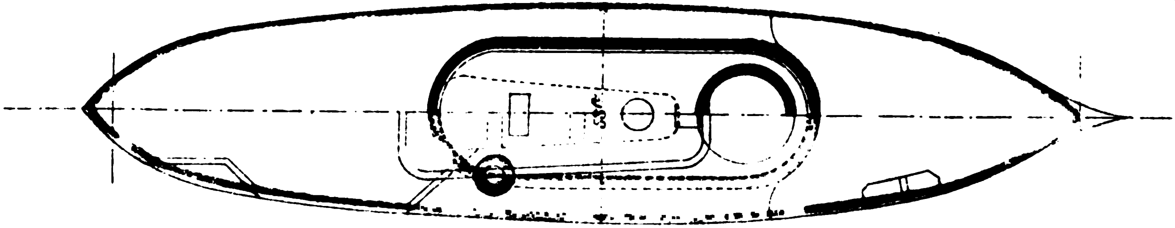
Pl. 21.

"Repulse."



"Rupert."





Breastwork Deck

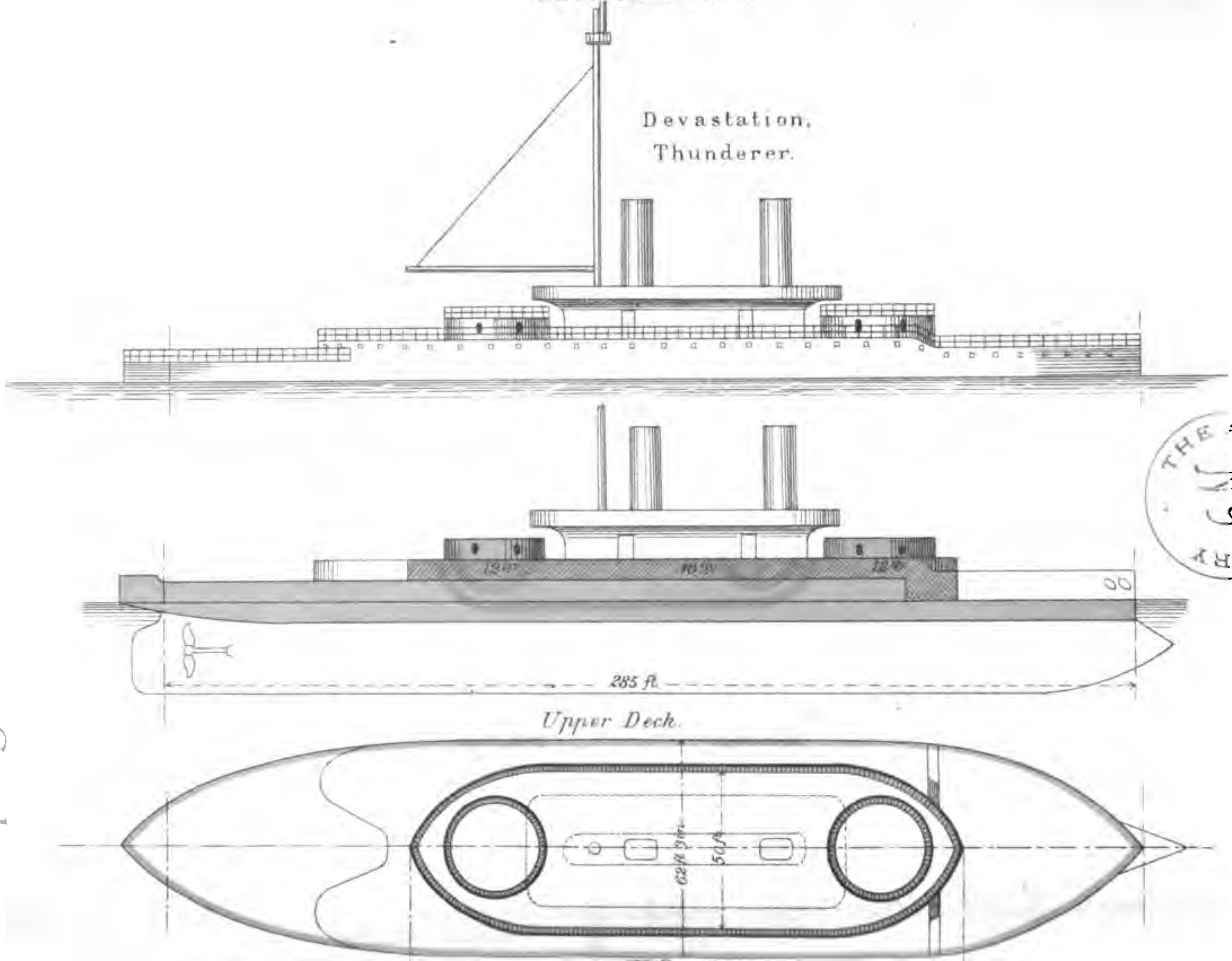
THE ASTOR LIBRARY
N Y

Hanhart lith.

BRITISH SHIPS.

Pl. 12.

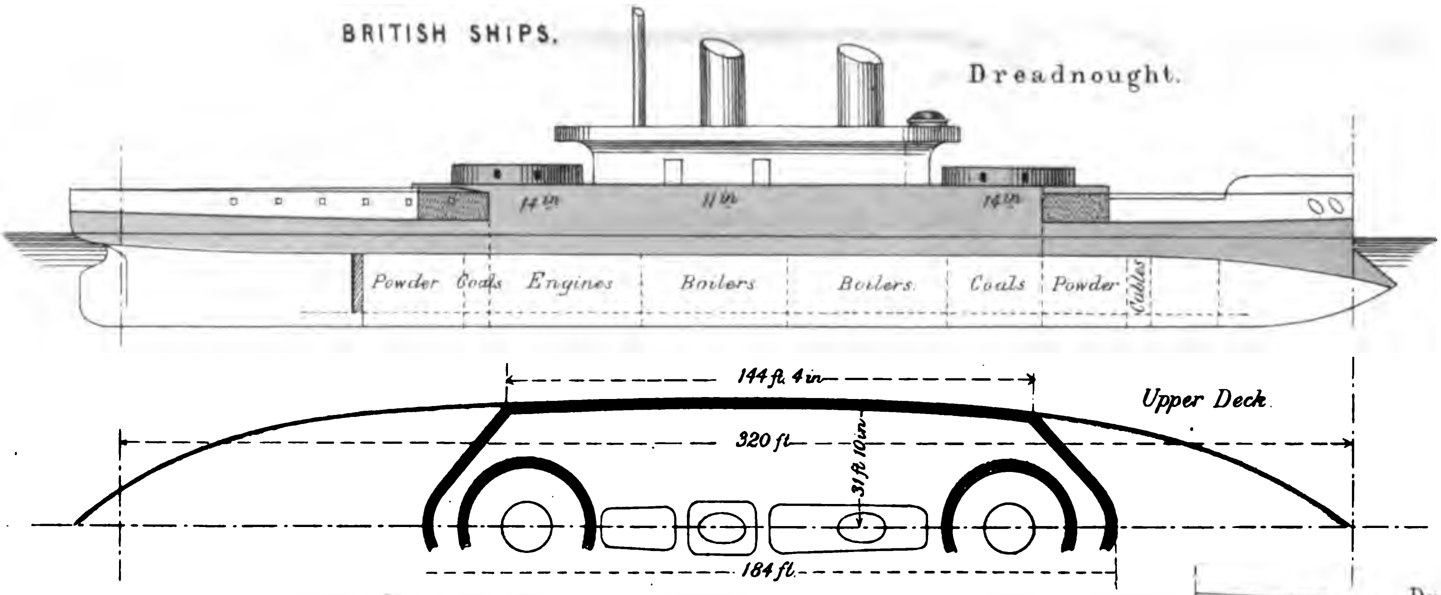
Devastation, Thunderer.

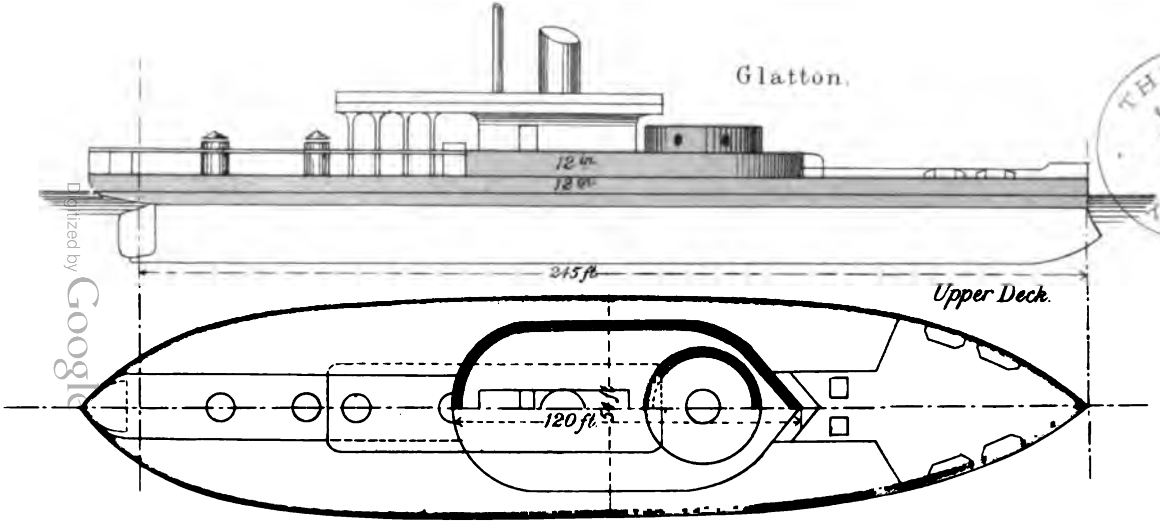


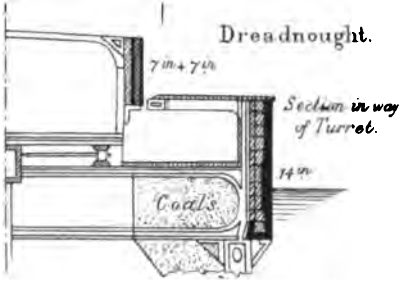
THE ASTOR LIBRARY
N.Y.

Pl. 13.

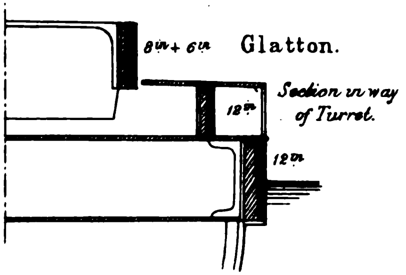
BRITISH SHIPS.


Dreadnought.


Glatton.


Dreadnought.

Section in way of Turret.


Glatton.

Section in way of Turret.

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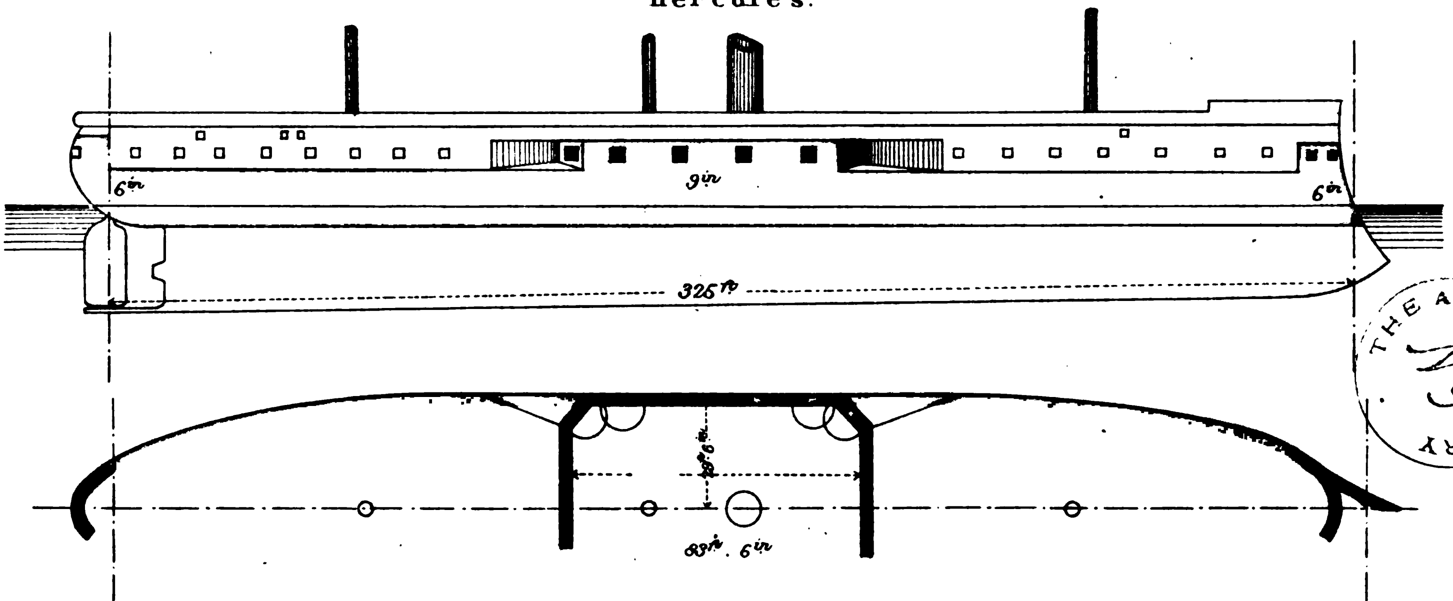
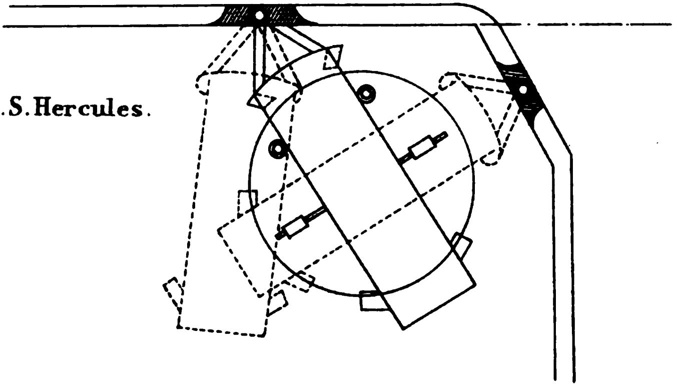
Pl. 14.

BRITISH SHIPS.

"Hercules."




Angle Port of H.M.S. Hercules.

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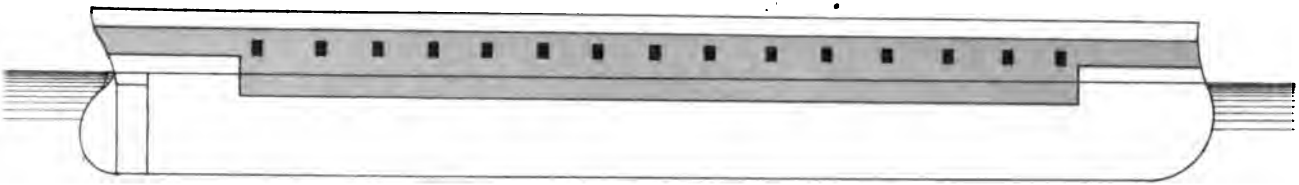
HANHART, LITH

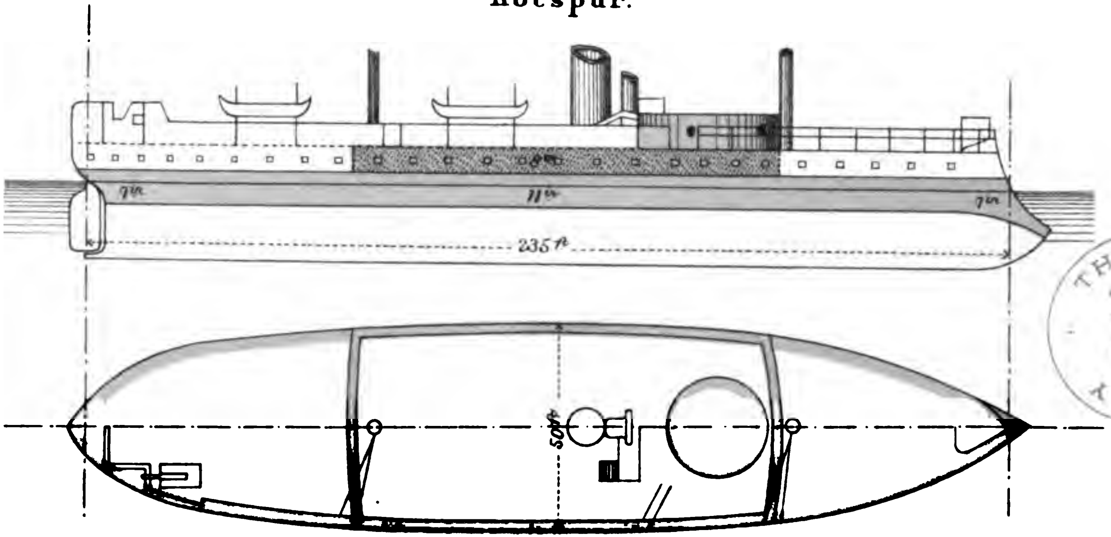
Pl. 15.

BRITISH SHIPS.

"Hector" & "Valient."



"Hotspur."



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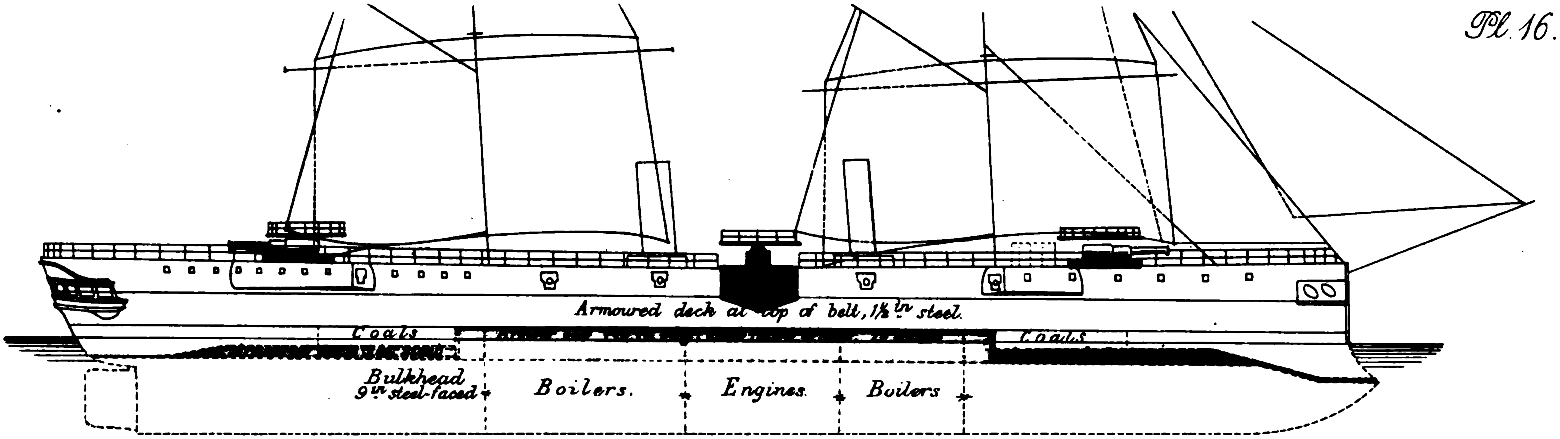
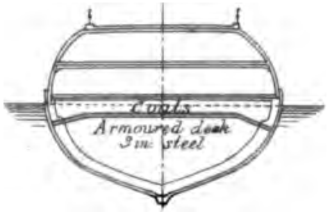
HANHART, LITH



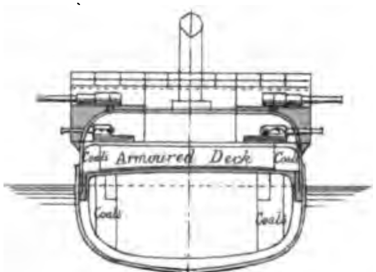


Section outside Armour belt.

Imperieuse,

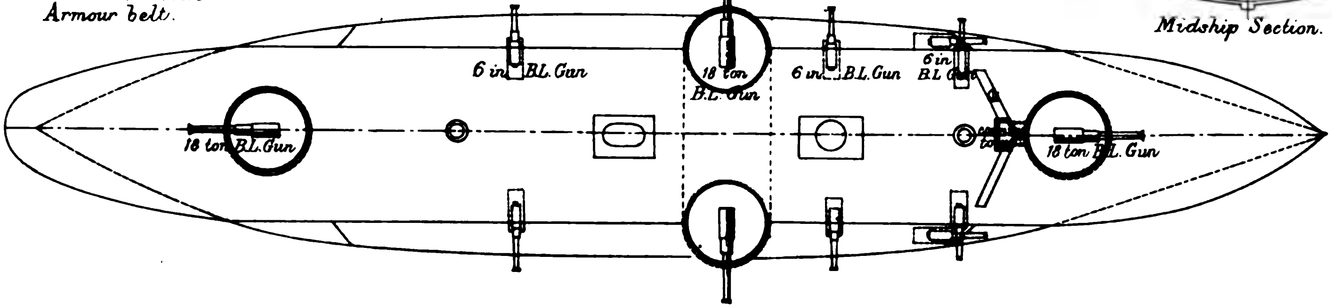
Warspite.

THE ... OR LIBRARY



Midship Section.

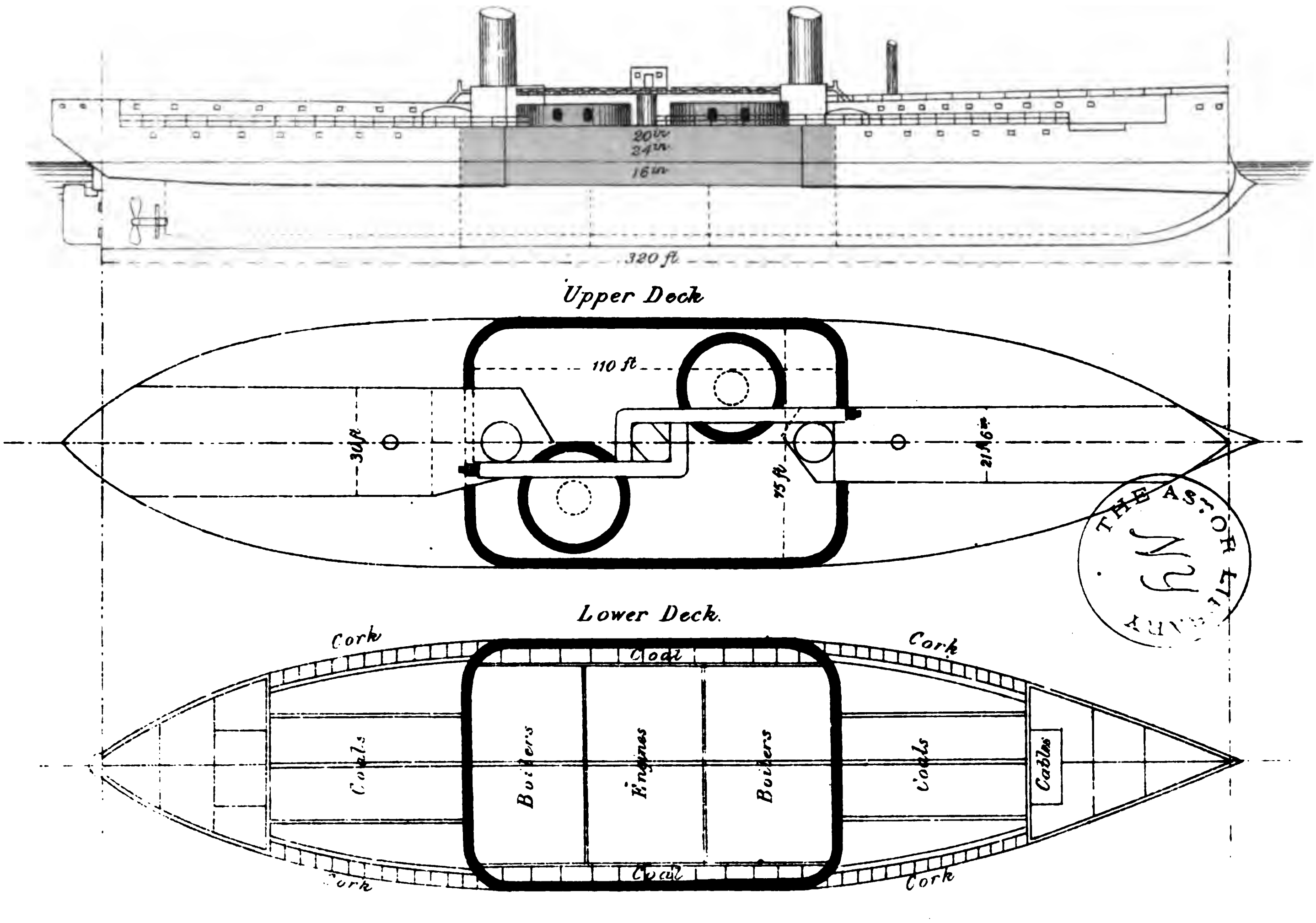
Upper Deck.



Pl. 17.

BRITISH SHIPS.

Inflexible.



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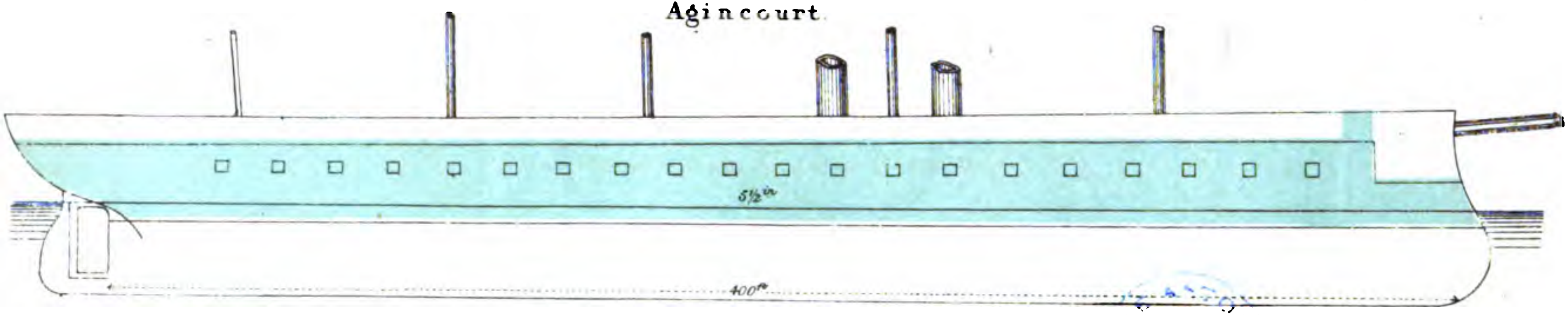
BRITISH SHIPS.

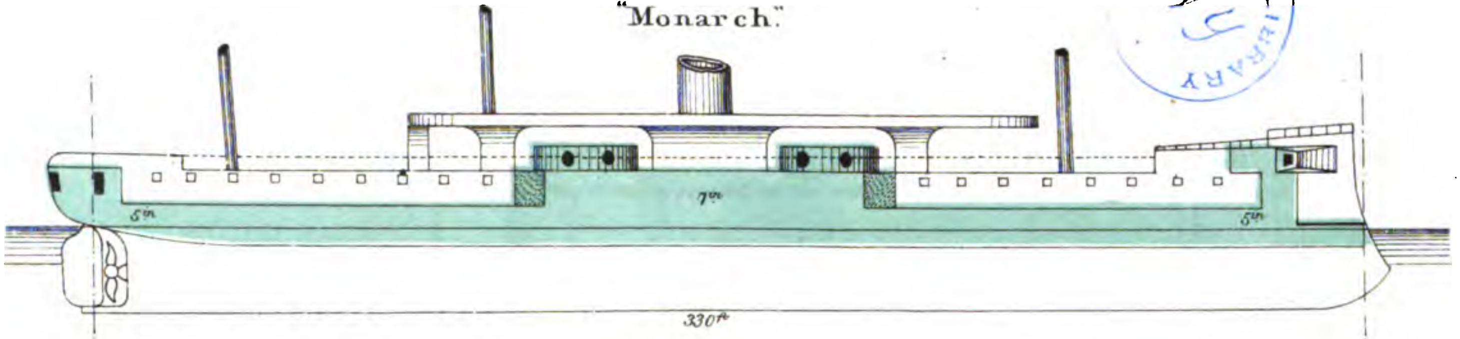
Pl. 18.

"Minotaur."

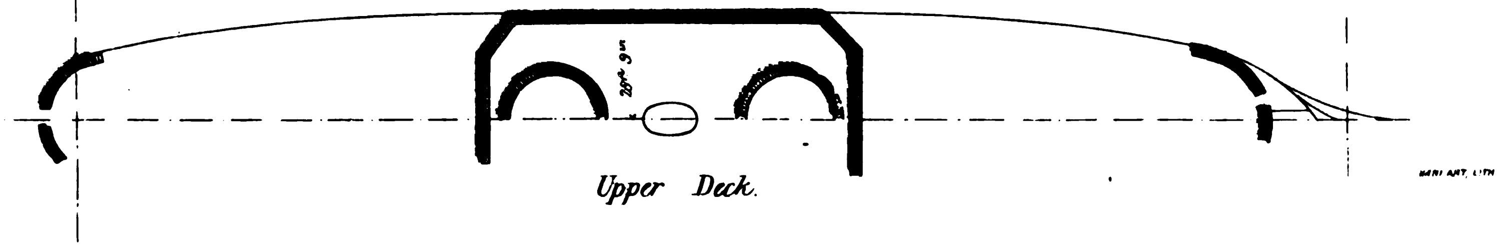
Agincourt.



"Monarch."



"Monarch".



Upper Deck.

[illegible] ART, LITH

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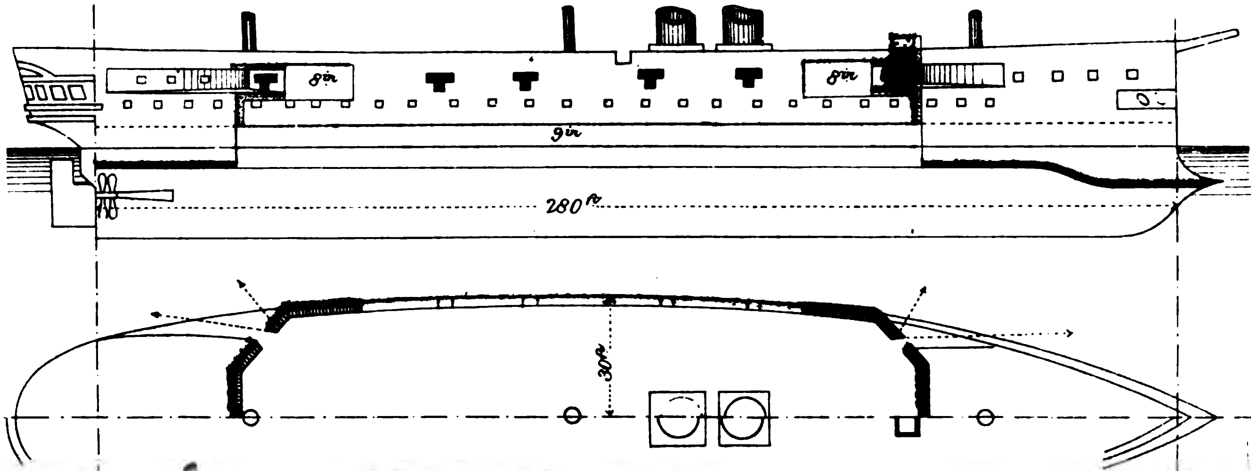
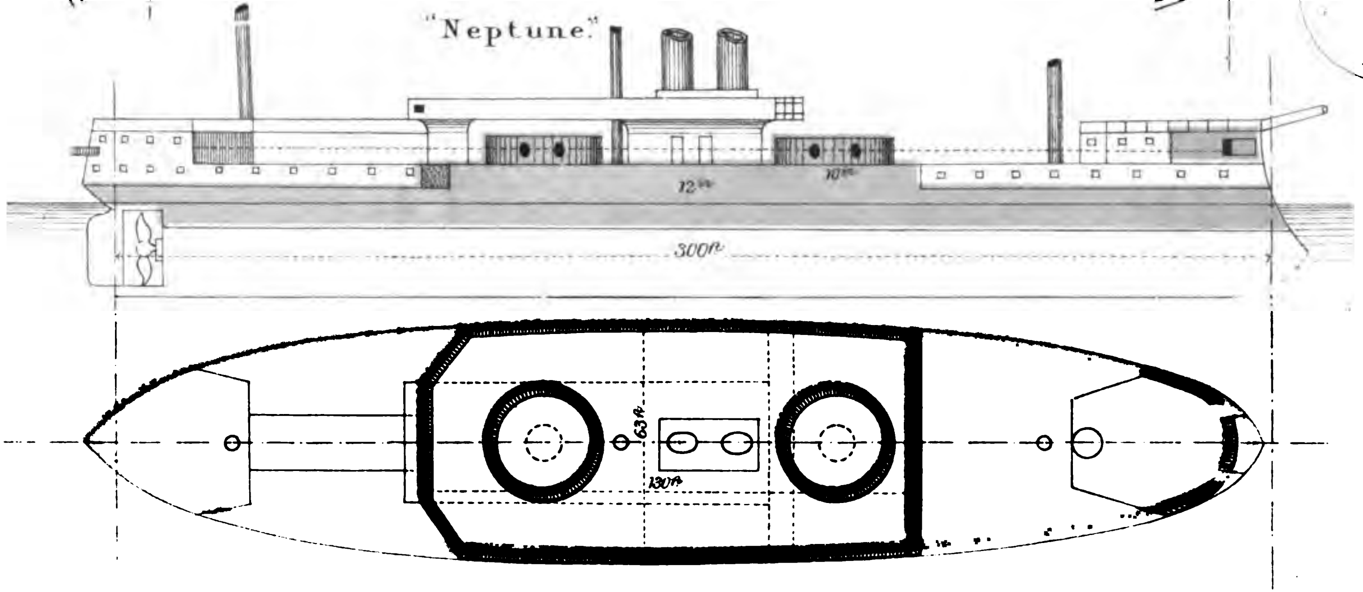
"Nelson."

Northampton.



"Neptune."



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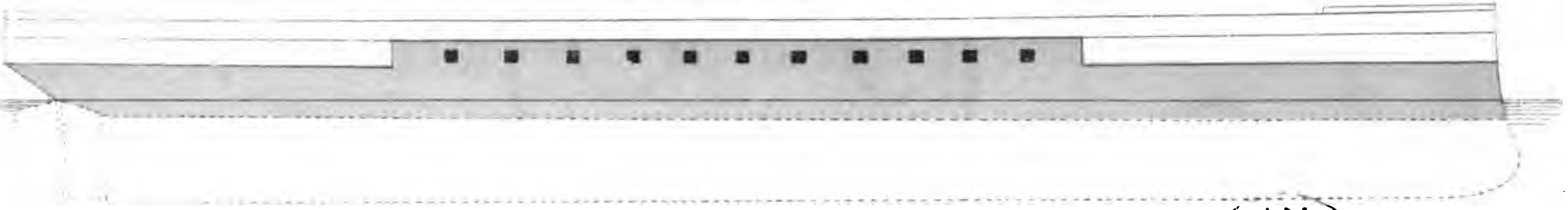
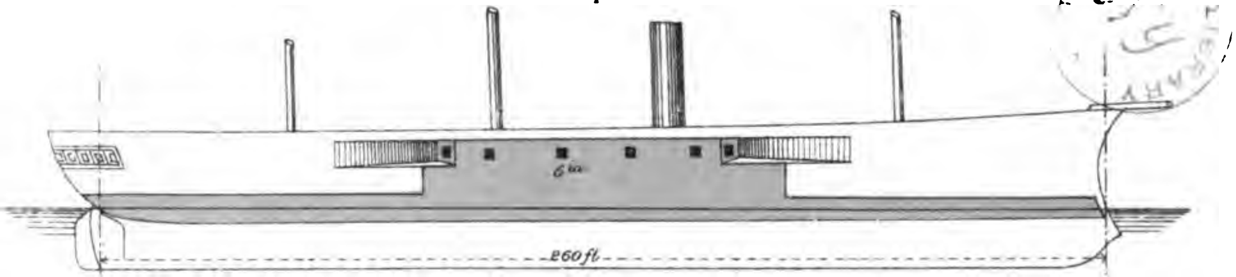
BRITISH SHIPS.

Northumberland.



Penelope.



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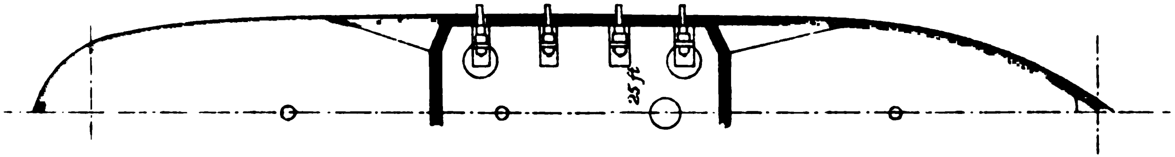
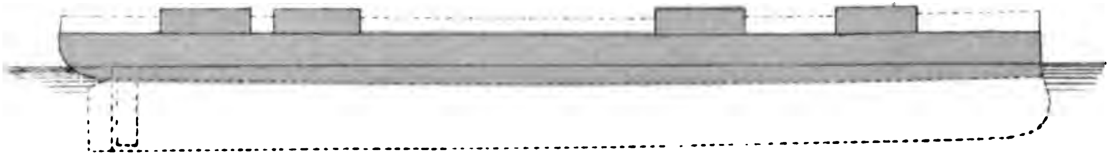
Main Deck.



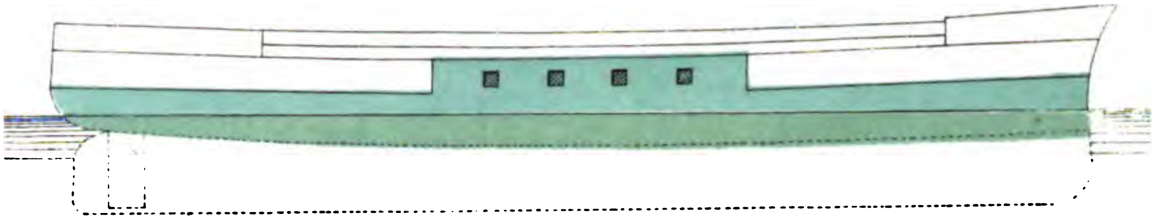
Prince Albert.



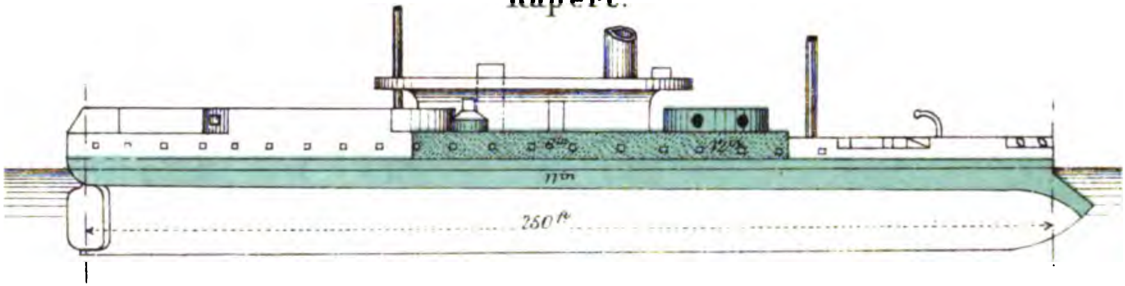
HAYNART, LITH

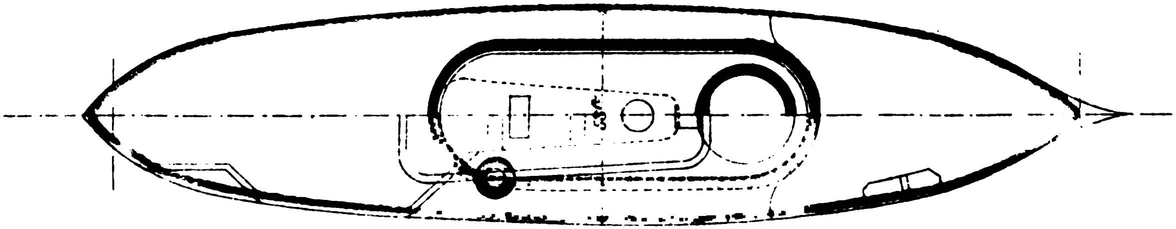
BRITISH SHIPS.

"Repulse."



"Rupert."





Breastwork Deck

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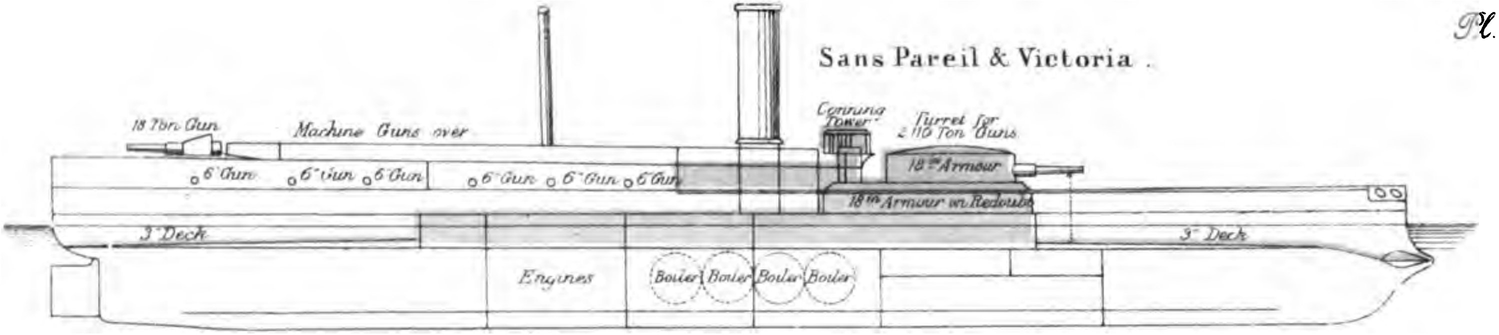
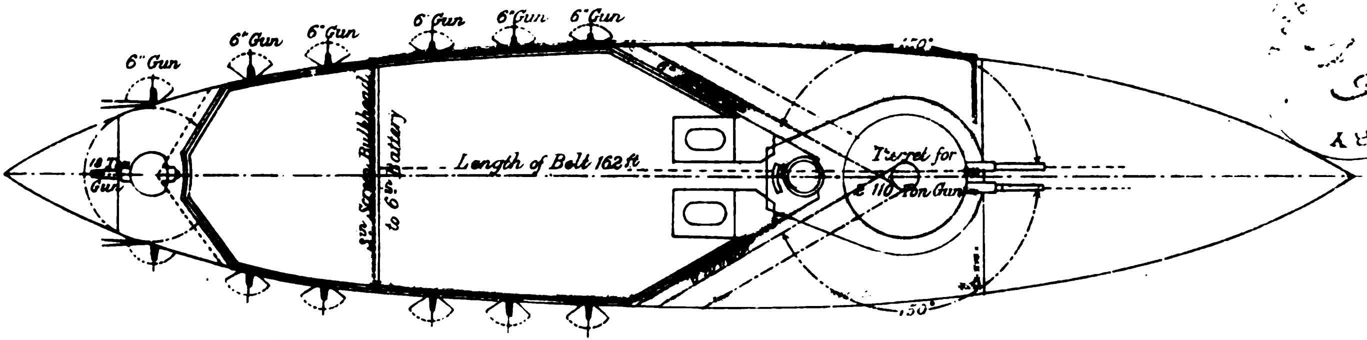
HANHART lith

BRITISH SHIPS.

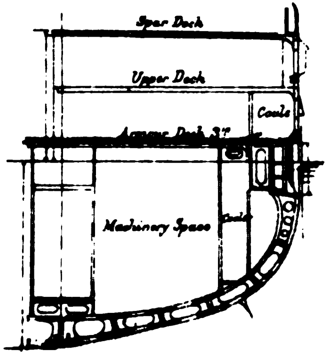
Pl. 22.

Sans Pareil & Victoria.

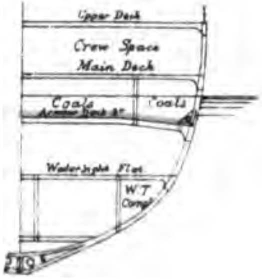




LIBRARY



Midship Section.

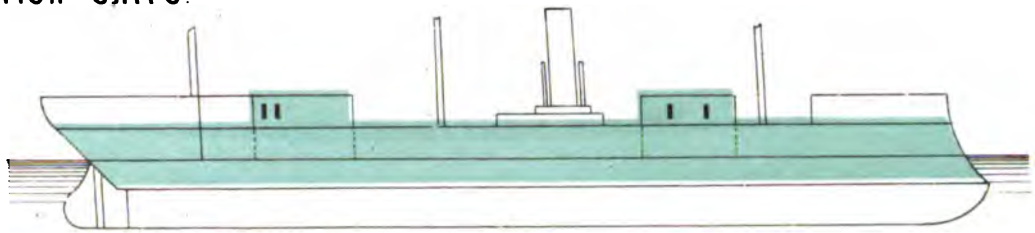


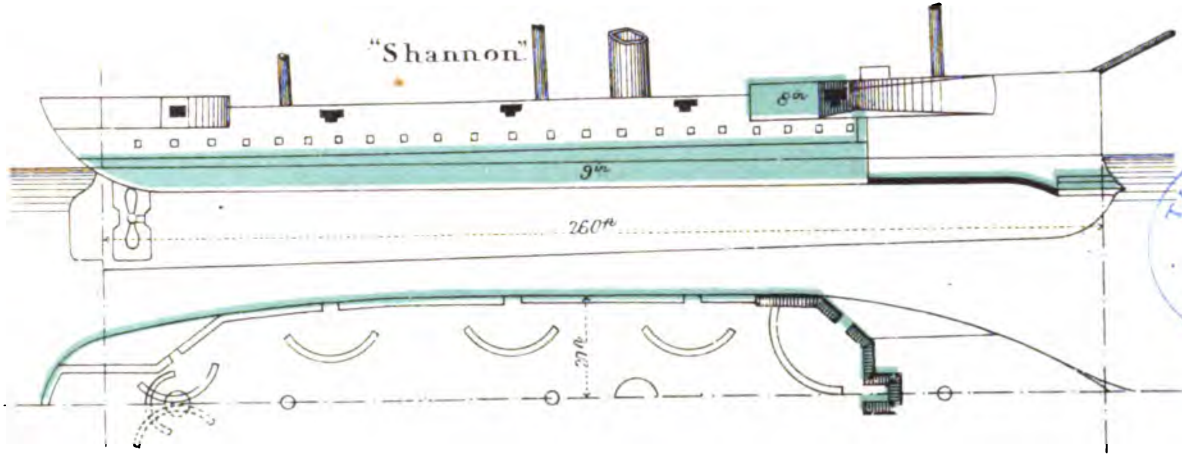
Section before Turret

HANHART LITH

BRITISH SHIPS.

"Scorpion" & "Wyvern."





"Shannon."

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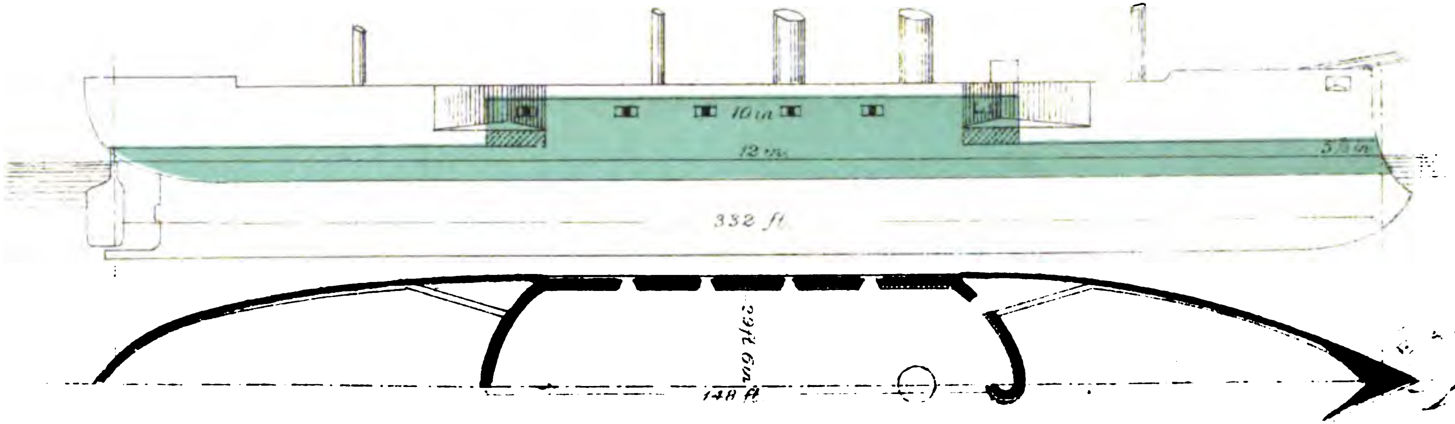
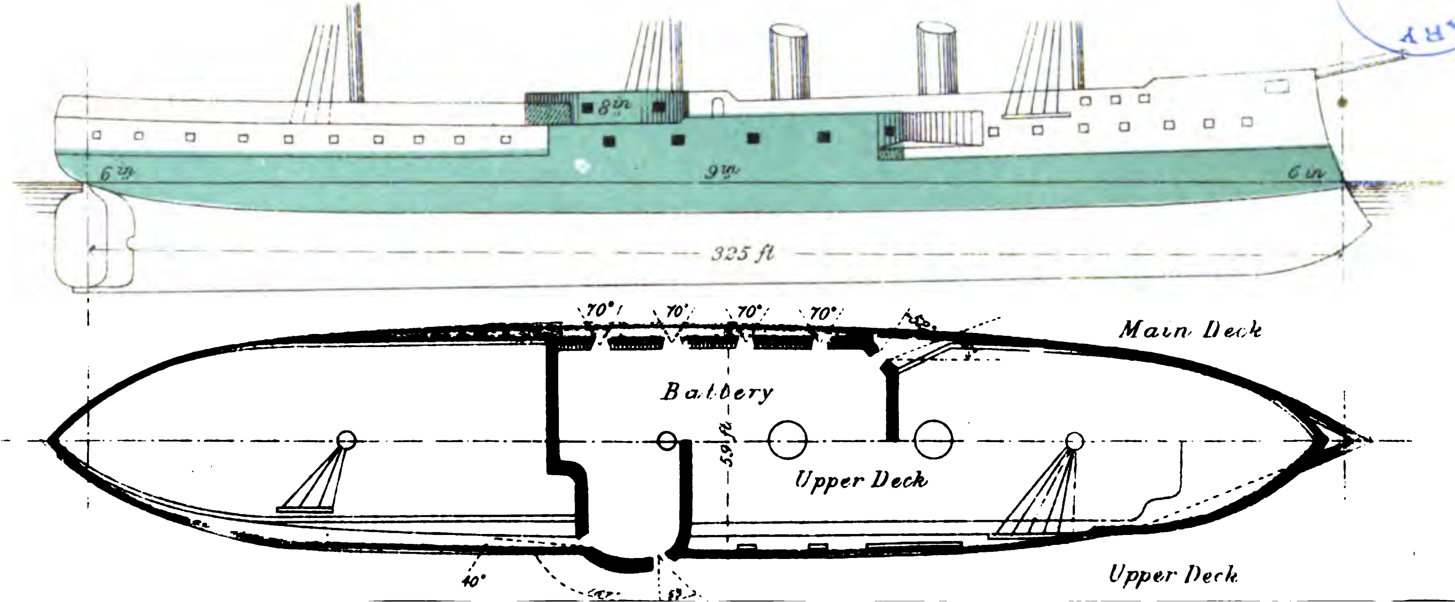
Pl. 24.

"Superb."



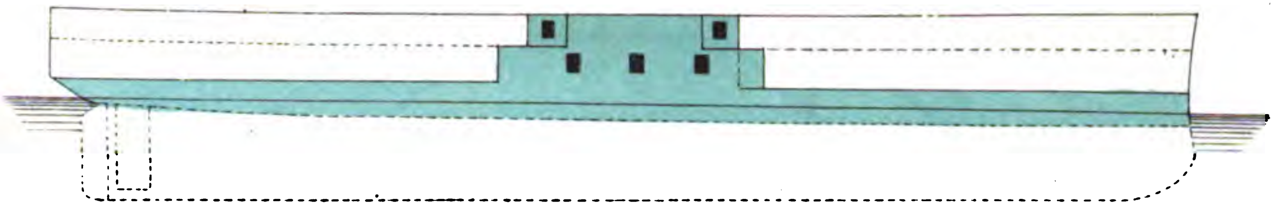
Sultan.



COR LIBRARY

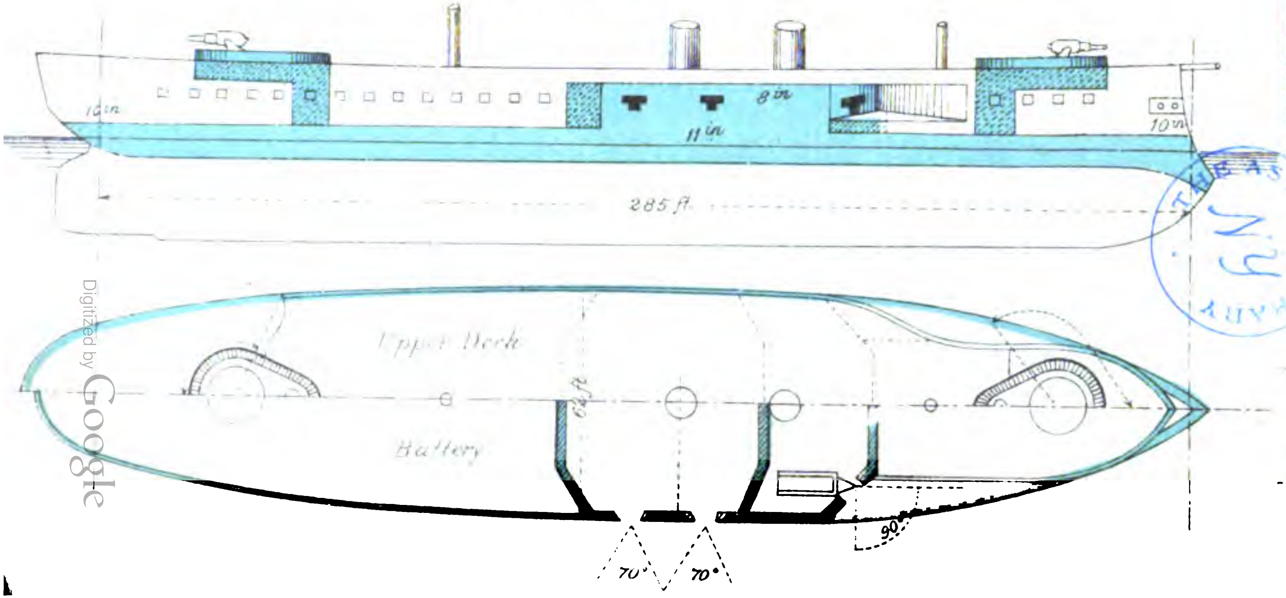
Pl. 25.

Swiftsure & Triumph.



BRITISH SHIPS

Téméraire.



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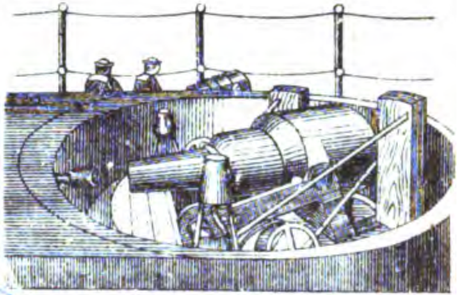
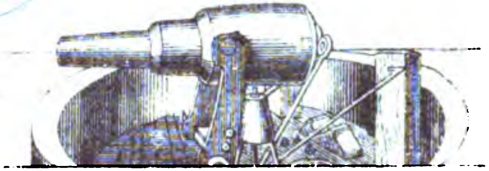


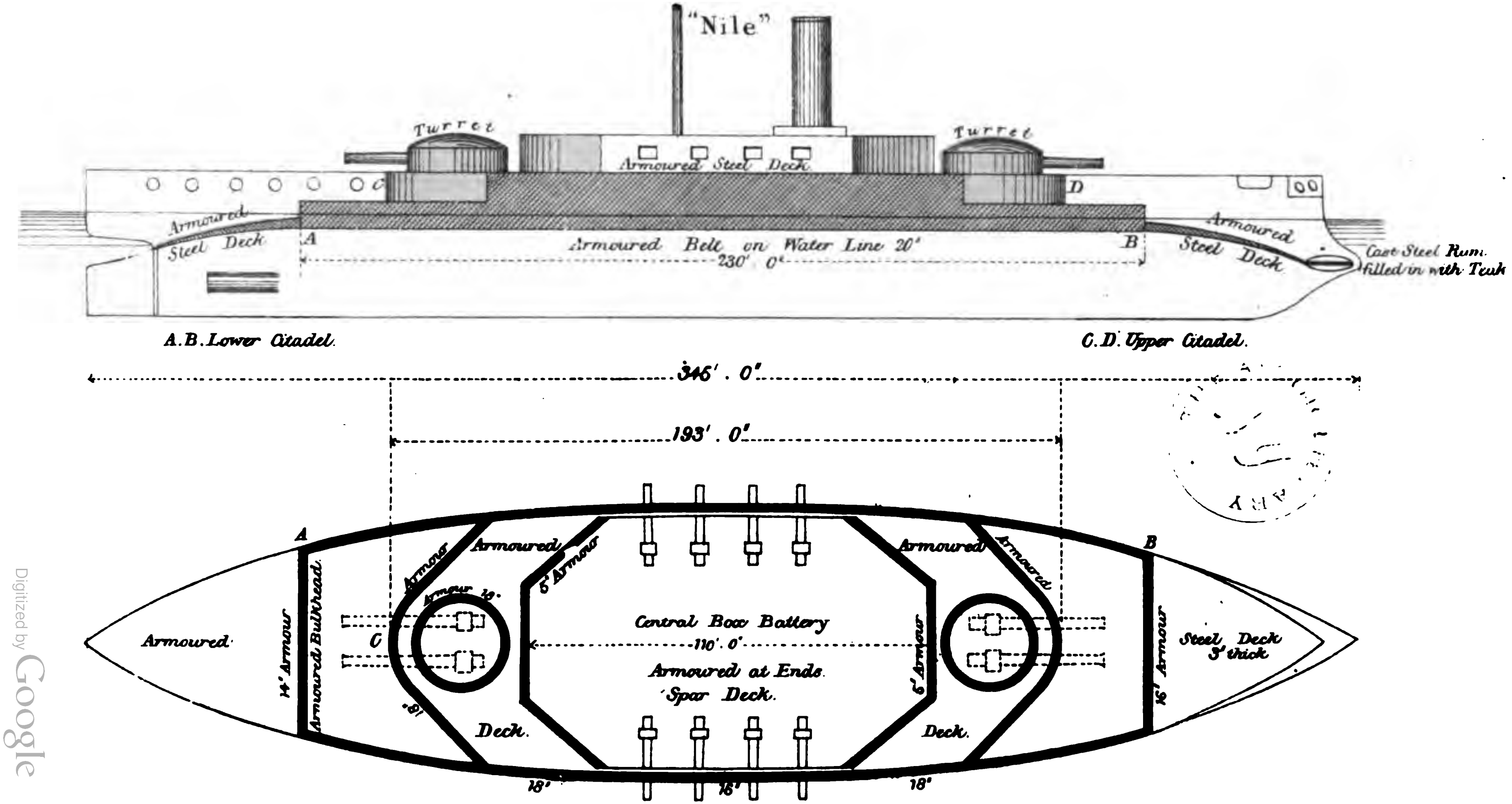
Téméraire's Gun, loading position.



Téméraire's Gun. firing position.

"Trafalgar".

"Nile"

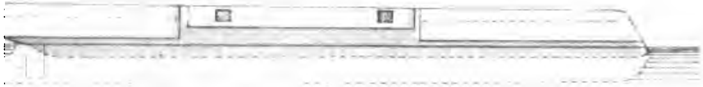


HANHART, LITH

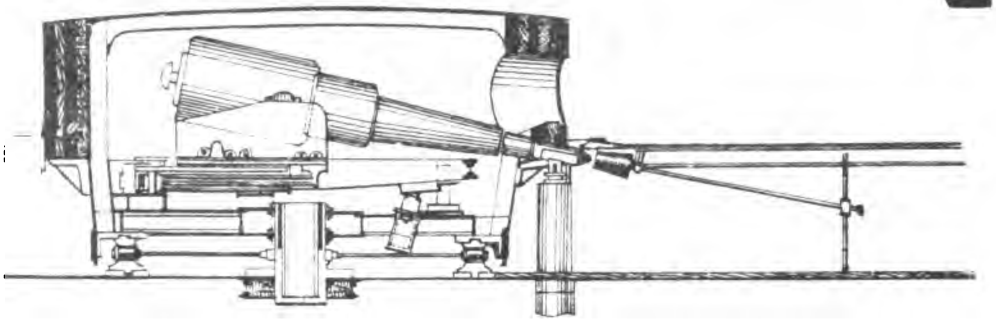
BRITISH SHIPS.

Pl. 27.

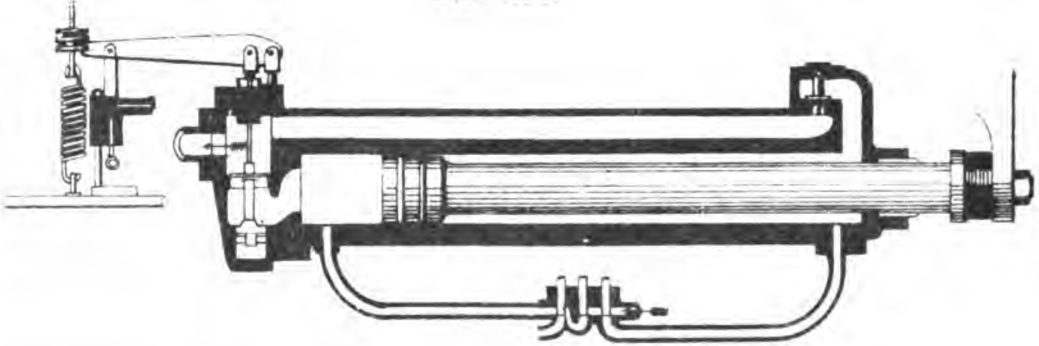
"Vixen" & "Viper".



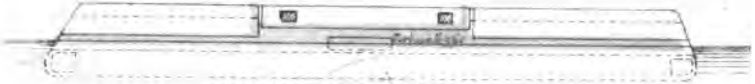
Thunderer.



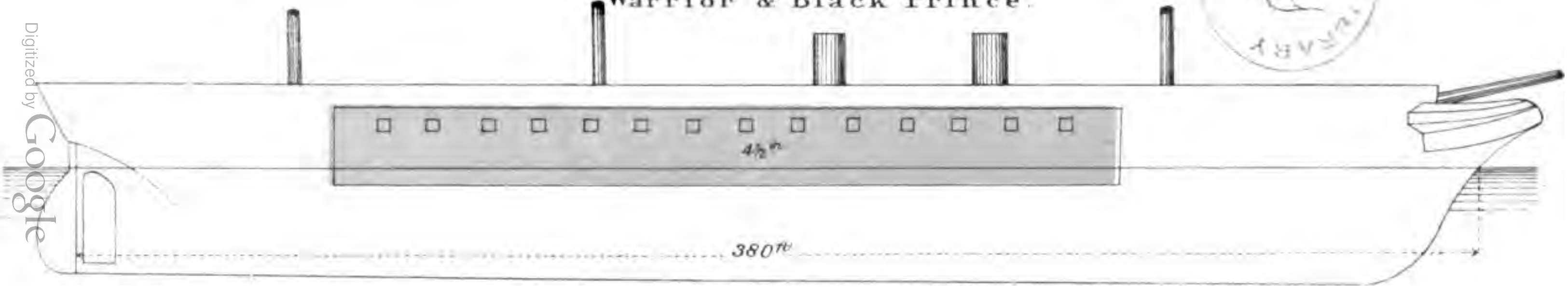
Thunderer



"Waterwitch"



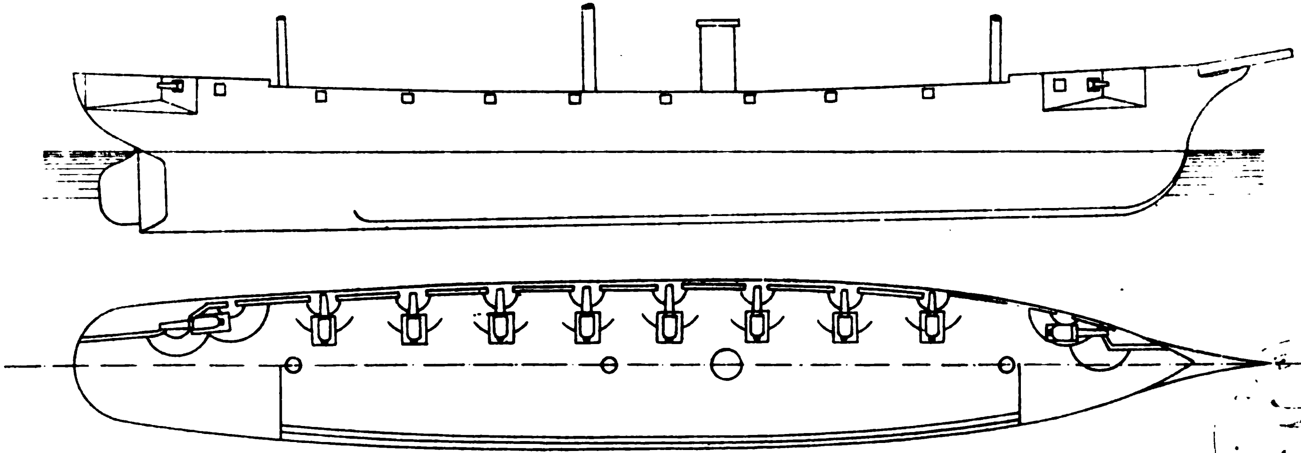
"Warrior" & "Black Prince".



BRITISH SHIPS.

Pl. 28.

"Active" & "Volage".



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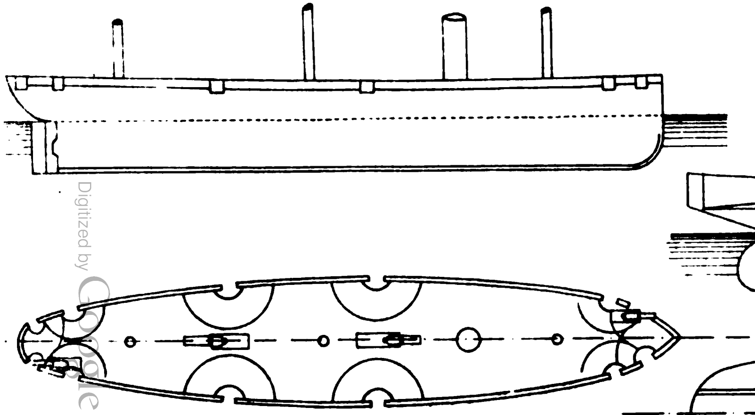
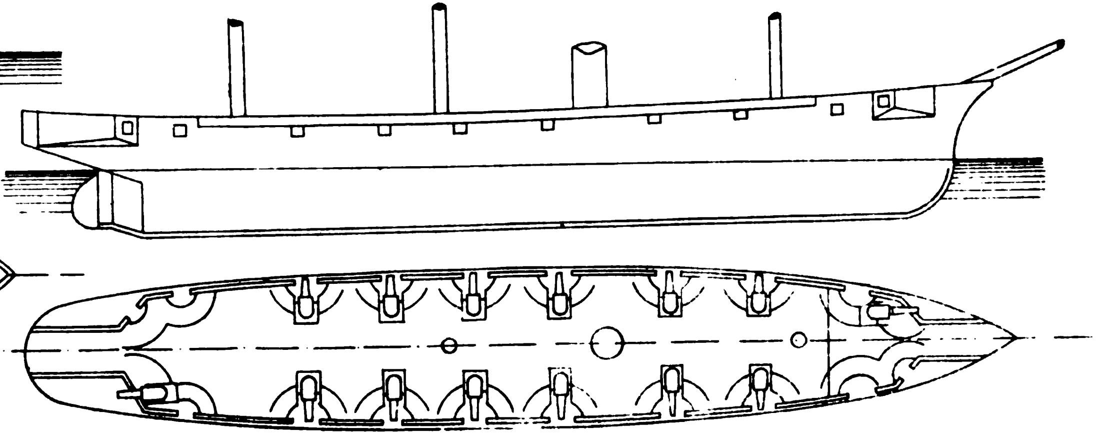
"Albatross".



"Amethyst"
"Modeste"
"Diamond".



HANHART LITH

BRITISH SHIPS.

"Alacrity & "Surprise"

Pl. 29.

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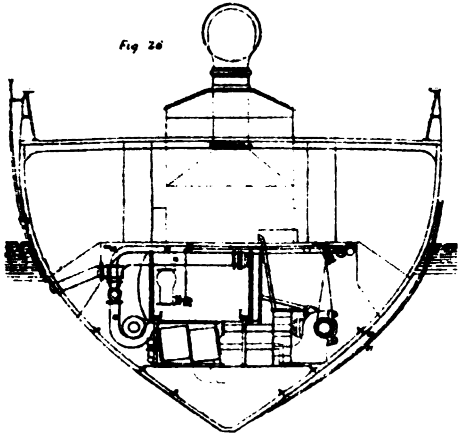
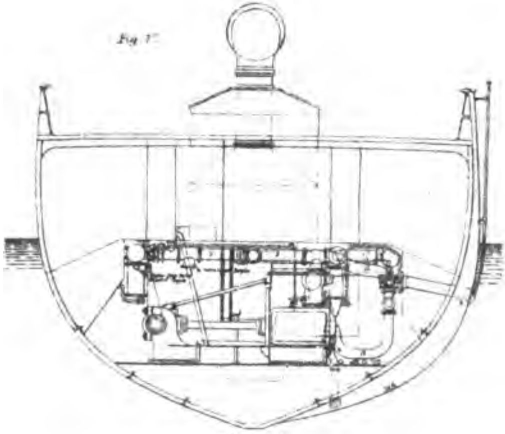
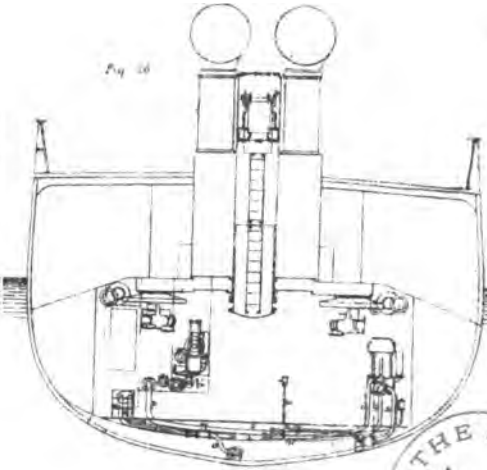
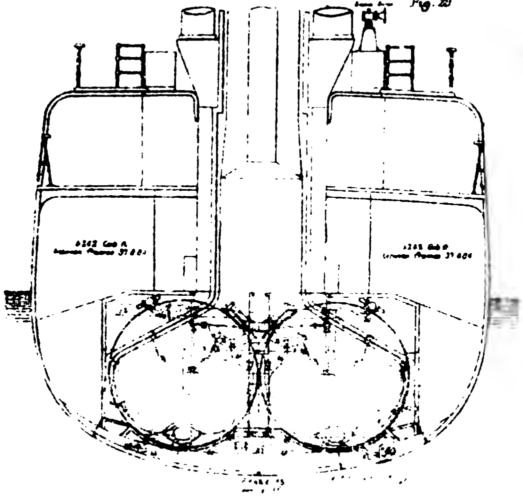
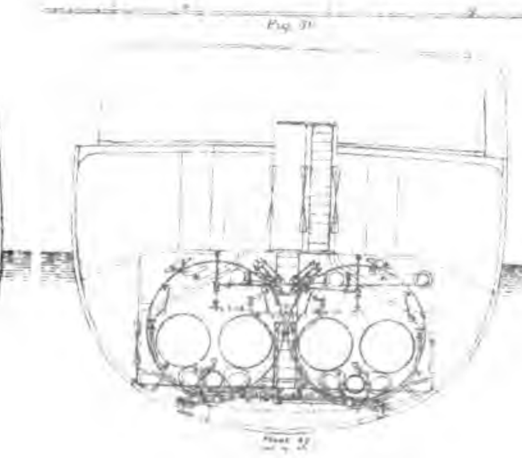
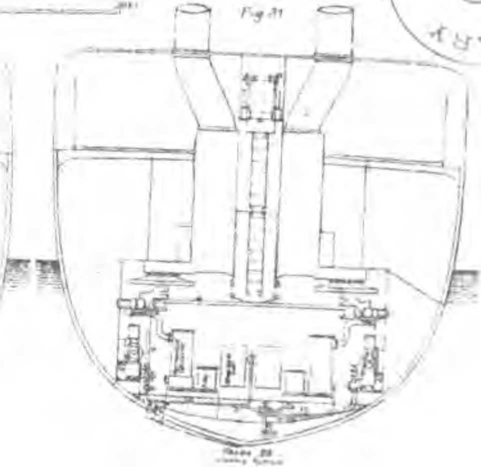






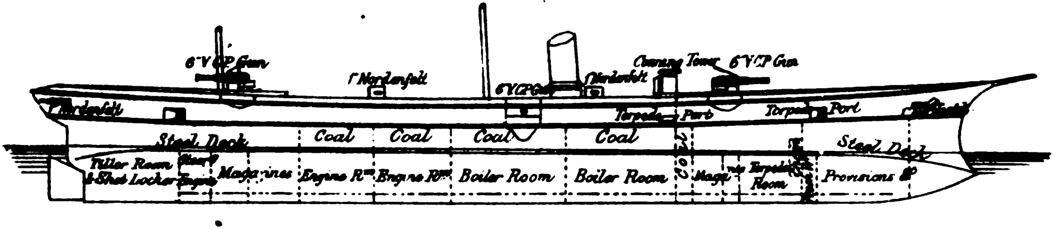




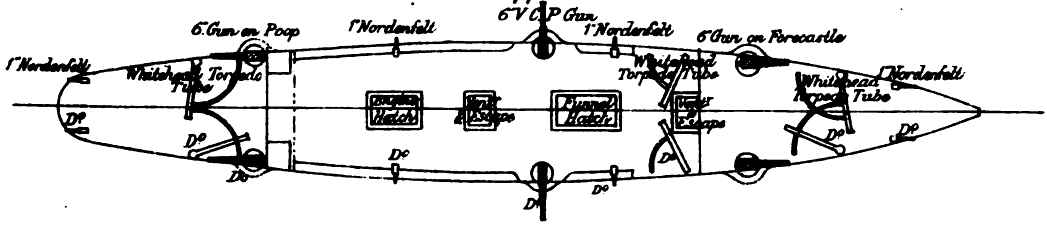


BRITISH SHIPS

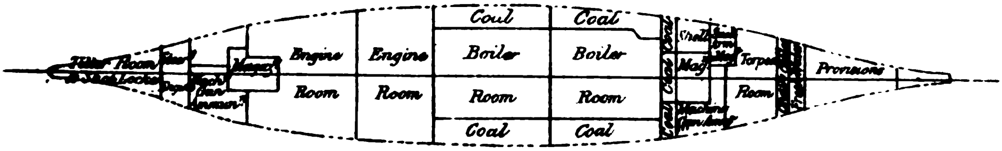
Vessels of Archer class { Archer, Mohawk, Serpent,
Brisk. Porpoise. Tartar.
Cossack, Racoon,



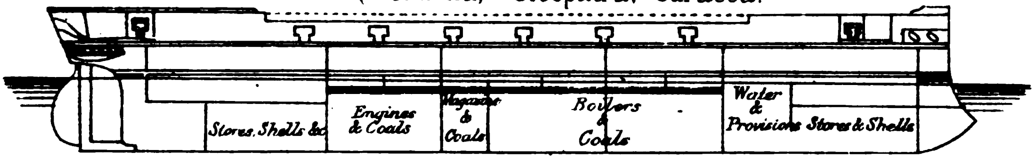
Plan of Upper Works.



Plan of Hold.



Vessels of Comus *class* { Canada, Carysfort, Comus, Constance, Champion, Conquest, Cordelia, Cleopatra, Curacoa.



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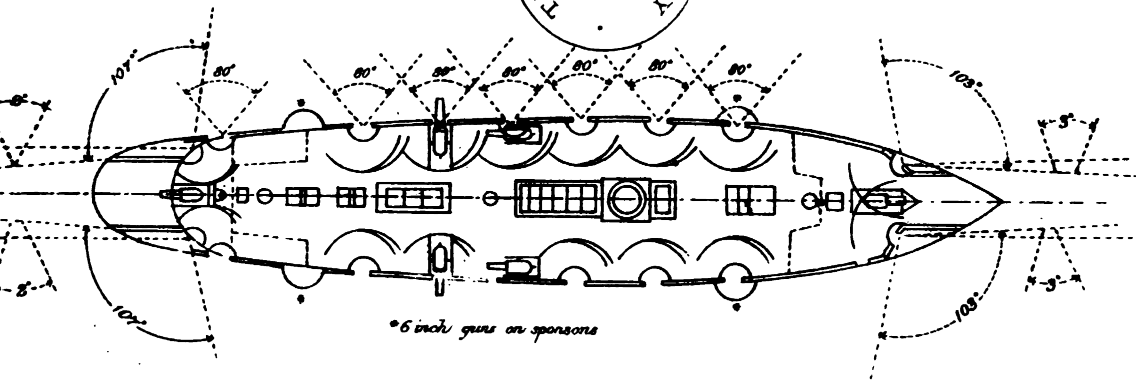
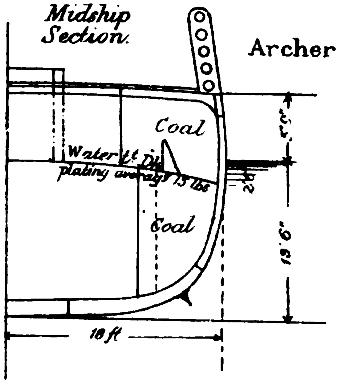
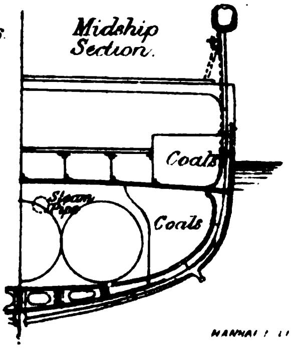


Archer *class.*

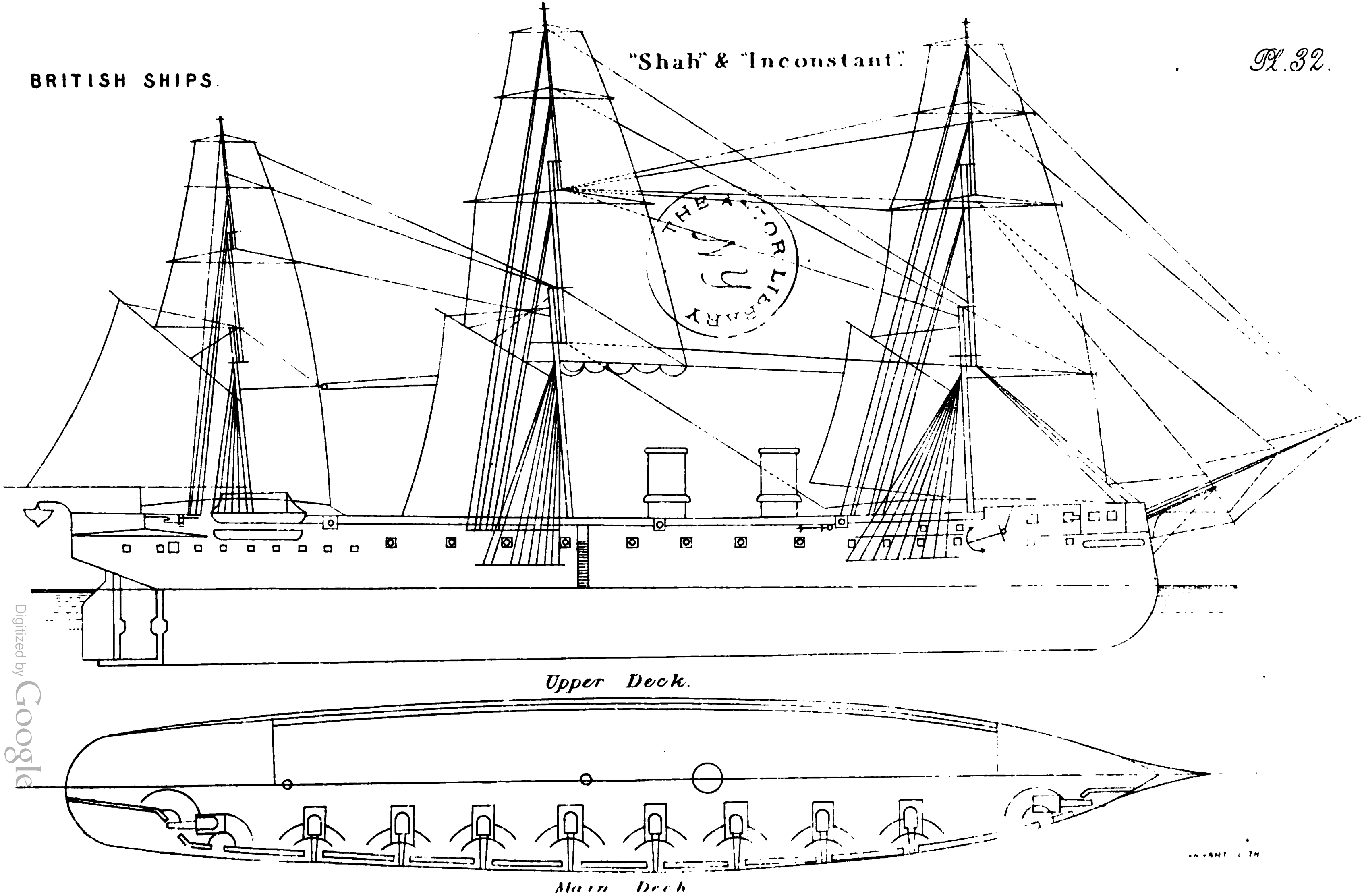


Comus *class.*



HANHART LITH

"Shah" & "Inconstant".



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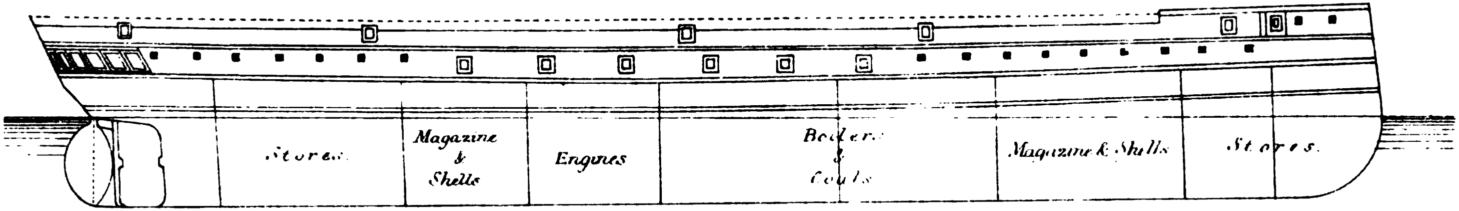
BRITISH SHIPS.

"Inconstant" & "Shah".



THE ASTOR LIBRARY
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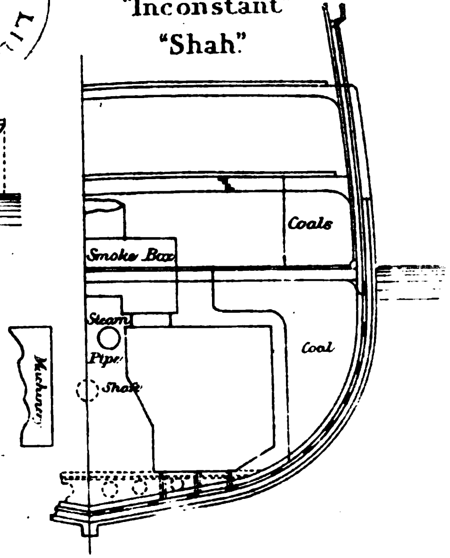
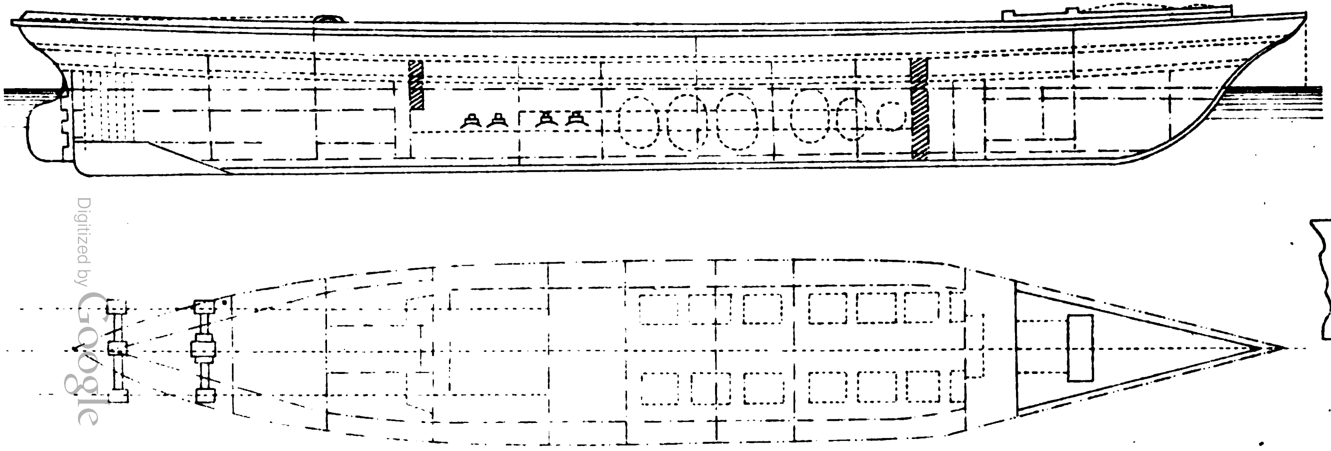
"Inconstant"
"Shah".



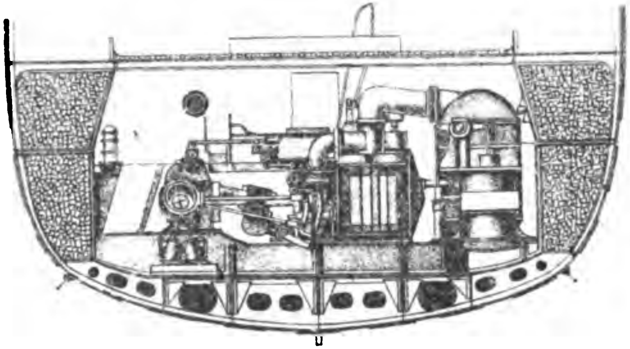
"Iris" & "Mercury".



HANHART, LITH

Pl. 34.

BRITISH SHIPS
"Iris"



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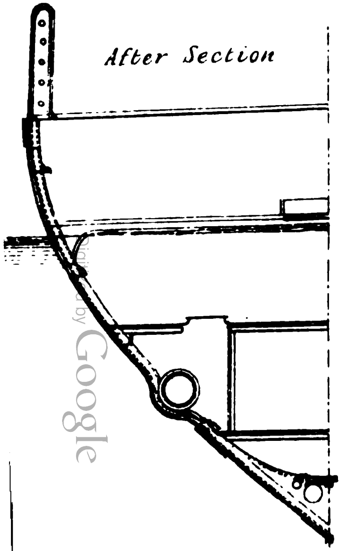
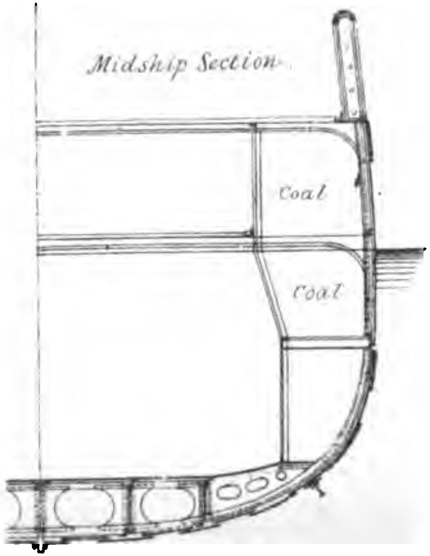
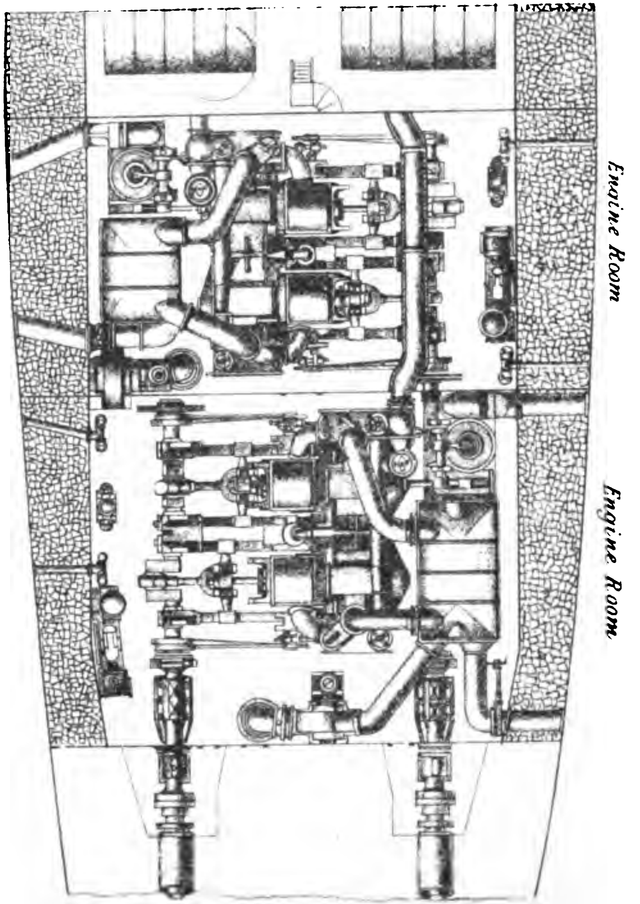


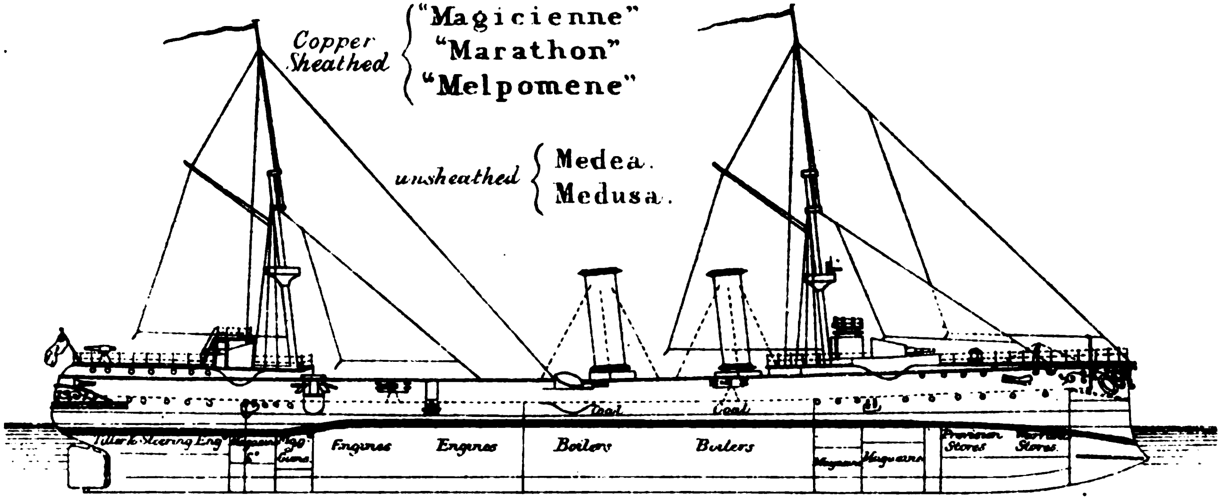




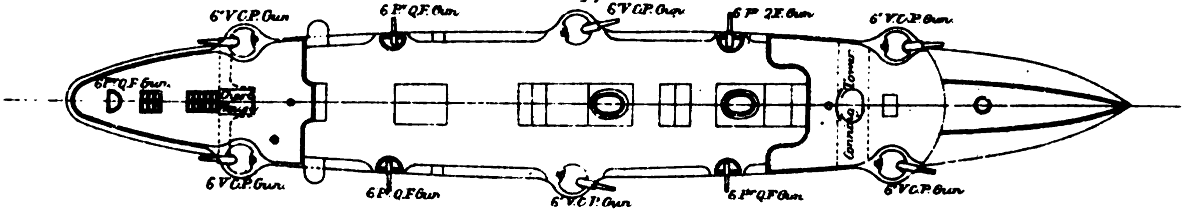
Wood Sheathed Protected Cruisers,

Copper Sheathed { "Magicienne" "Marathon" "Melpomene"

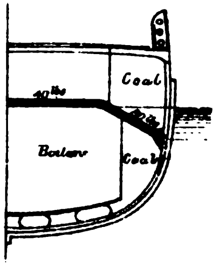
unsheathed { Medea. Medusa.



Plan of Upper Works.



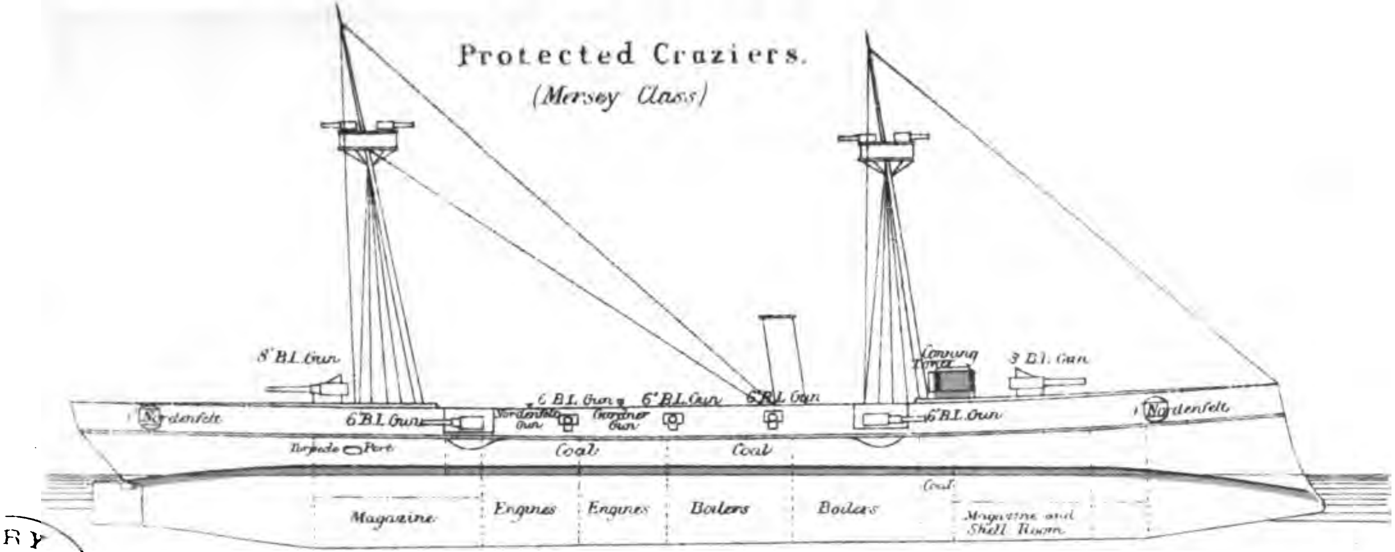
Midship Section

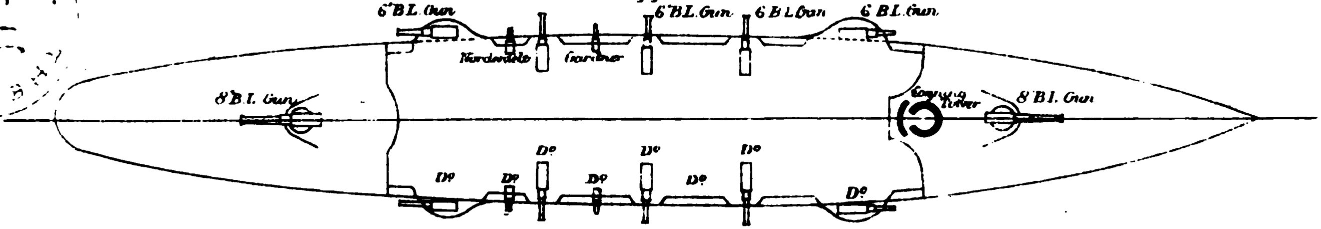


Pl. 36

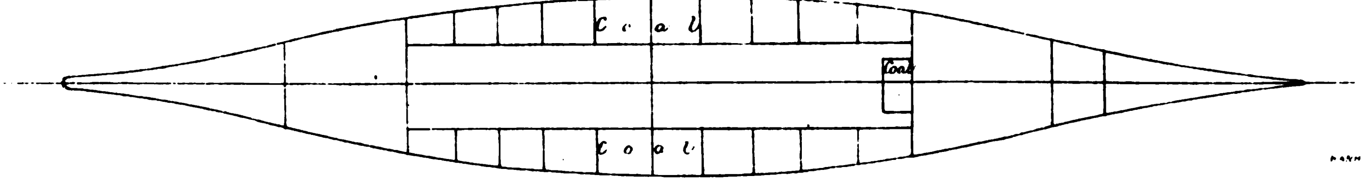
Protected Cruziers.

(Mersey Class)





Plan of Upper Deck.

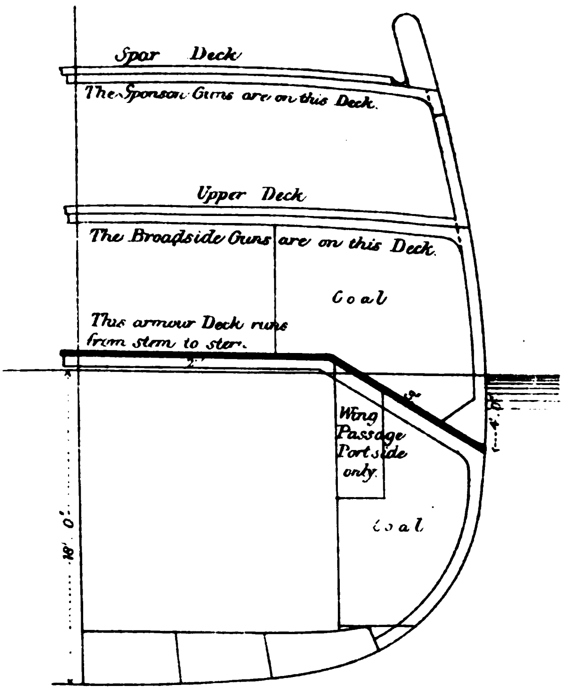


Plan of Protective Deck

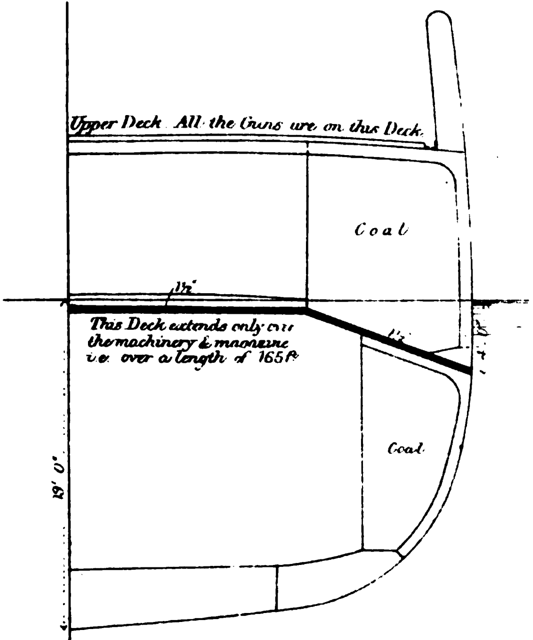
HANHART LITH

BRITISH SHIPS.

Midship Section of "Mersey."


Spar Deck
The Sponson Guns are on this Deck.
Upper Deck
The Broadside Guns are on this Deck.
Coal
This armour Deck runs from stem to stern.
2"
3"
Wing Passage Port side only.
Coal
18' 0"
4' 0"

Midship Section of "Leander"


Upper Deck All the Guns are on this Deck.
Coal
1½"
This Deck extends only over the machinery & magazine i.e. over a length of 165 ft
1½"
Coal
19' 0"

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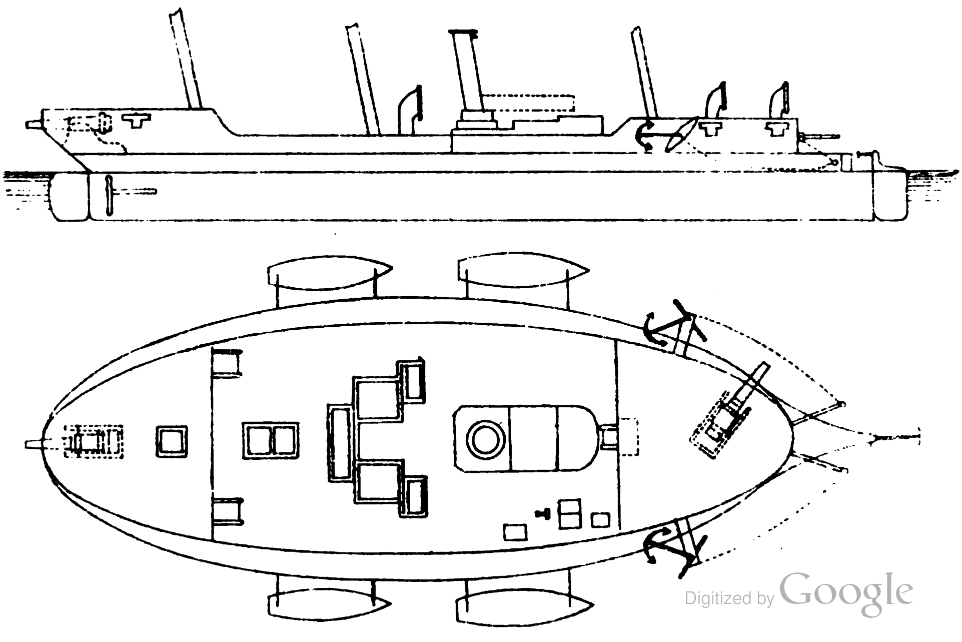
BRITISH SHIPS.

"Medina" class.

(On special Scale)

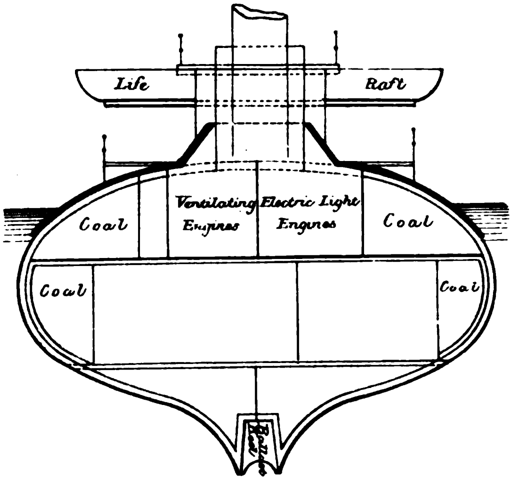


Pl. 38.

BRITISH SHIPS.

Polyphemus.

Midship Section.



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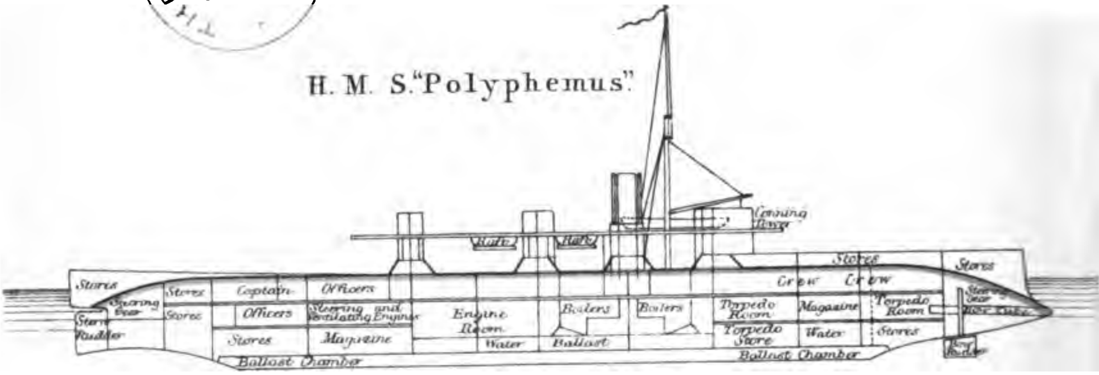
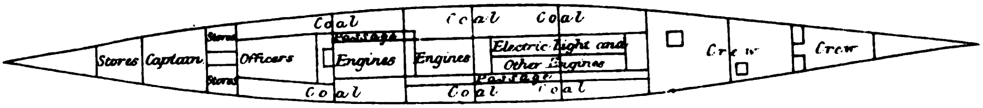
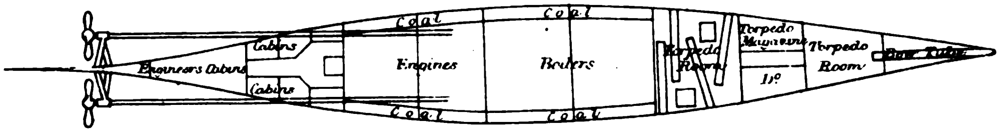
H. M. S. "Polyphemus".



Main Deck.

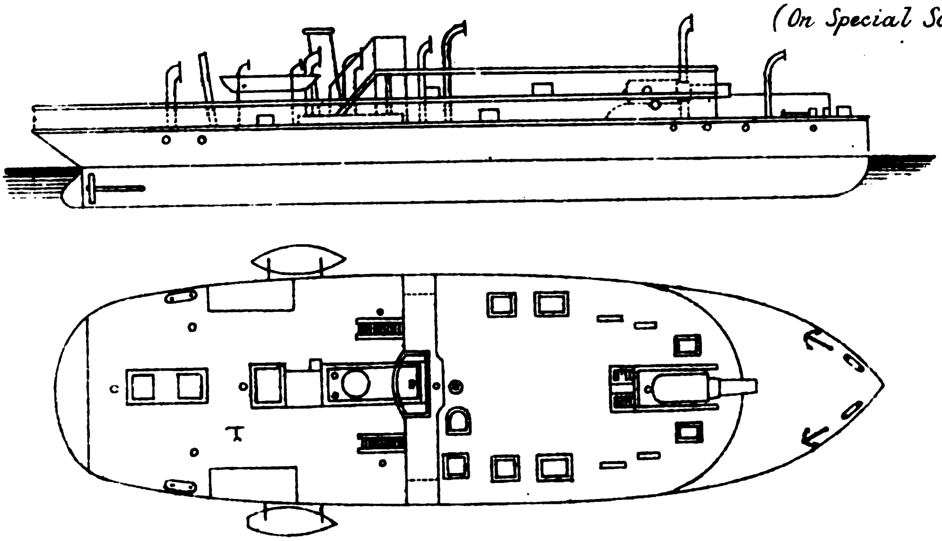


Lower Deck.



"Staunch," class

(On Special Scale)



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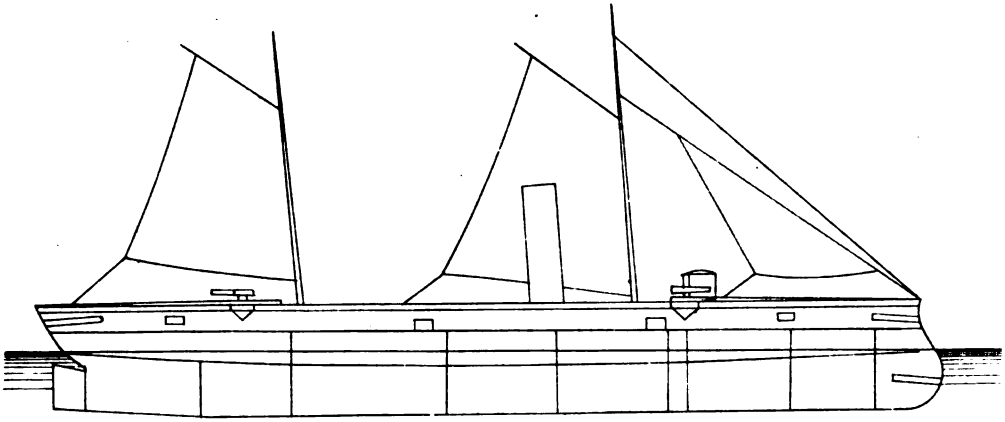
NY

"Scout" & "Fearless".



HANHART, LITH

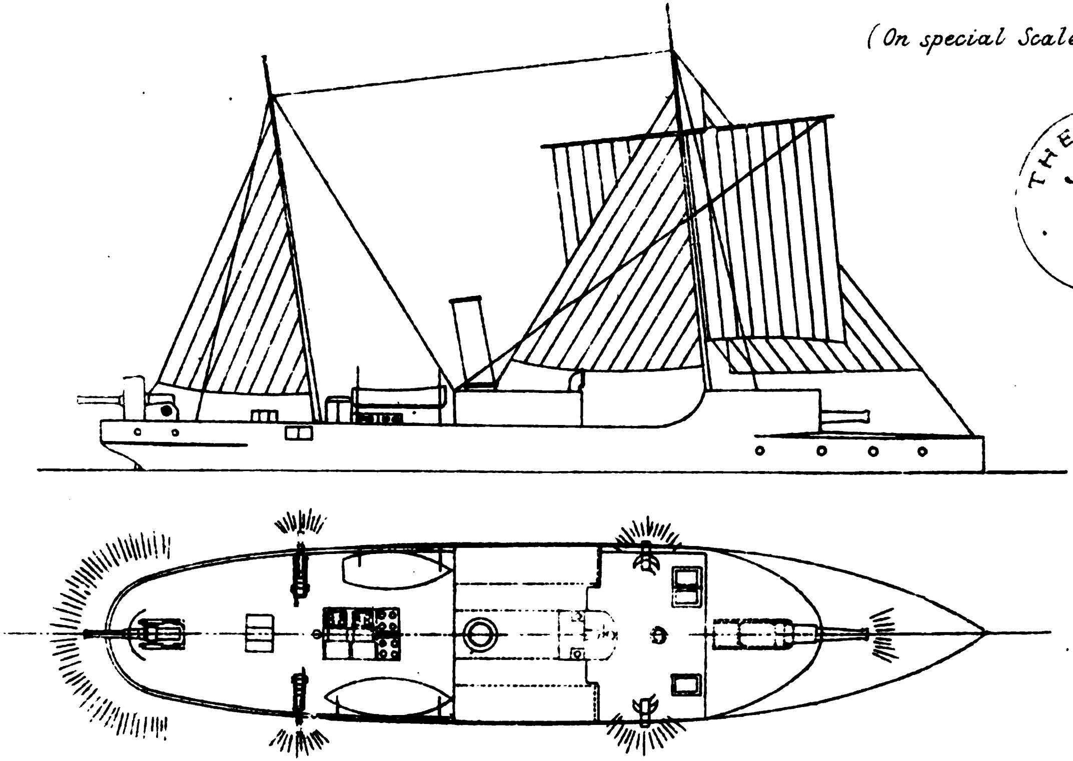
Pl. 40.

BRITISH COLONIAL (VICTORIA) SHIP.

"Albert"

(On special Scale)

THE ASTOR LIBRARY
N.Y.



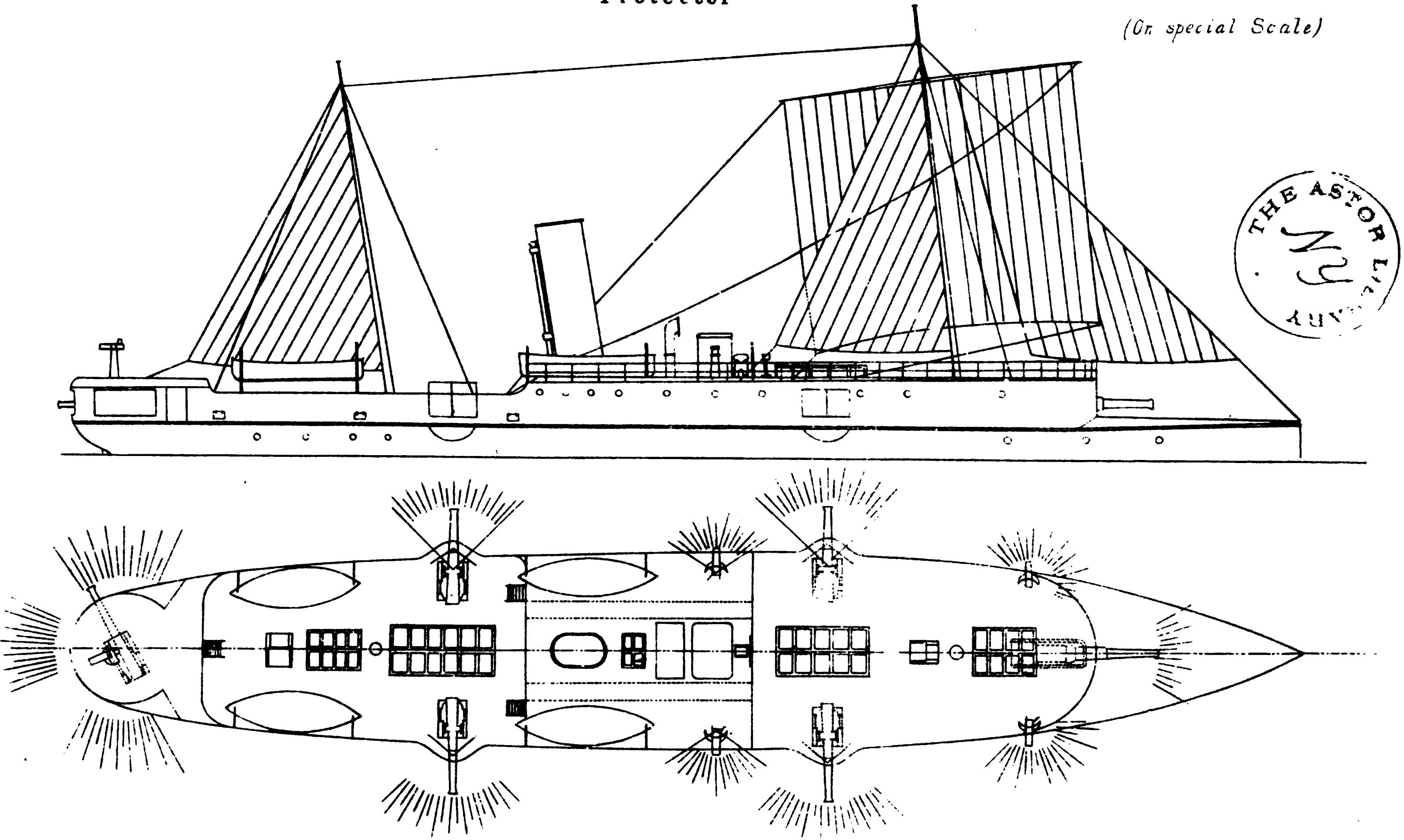
BRITISH COLONIAL (SOUTH AUSTRALIA) SHIP.

Pl. 41.

"Protector"

(On special Scale)

THE ASTOR LIBRARY NY

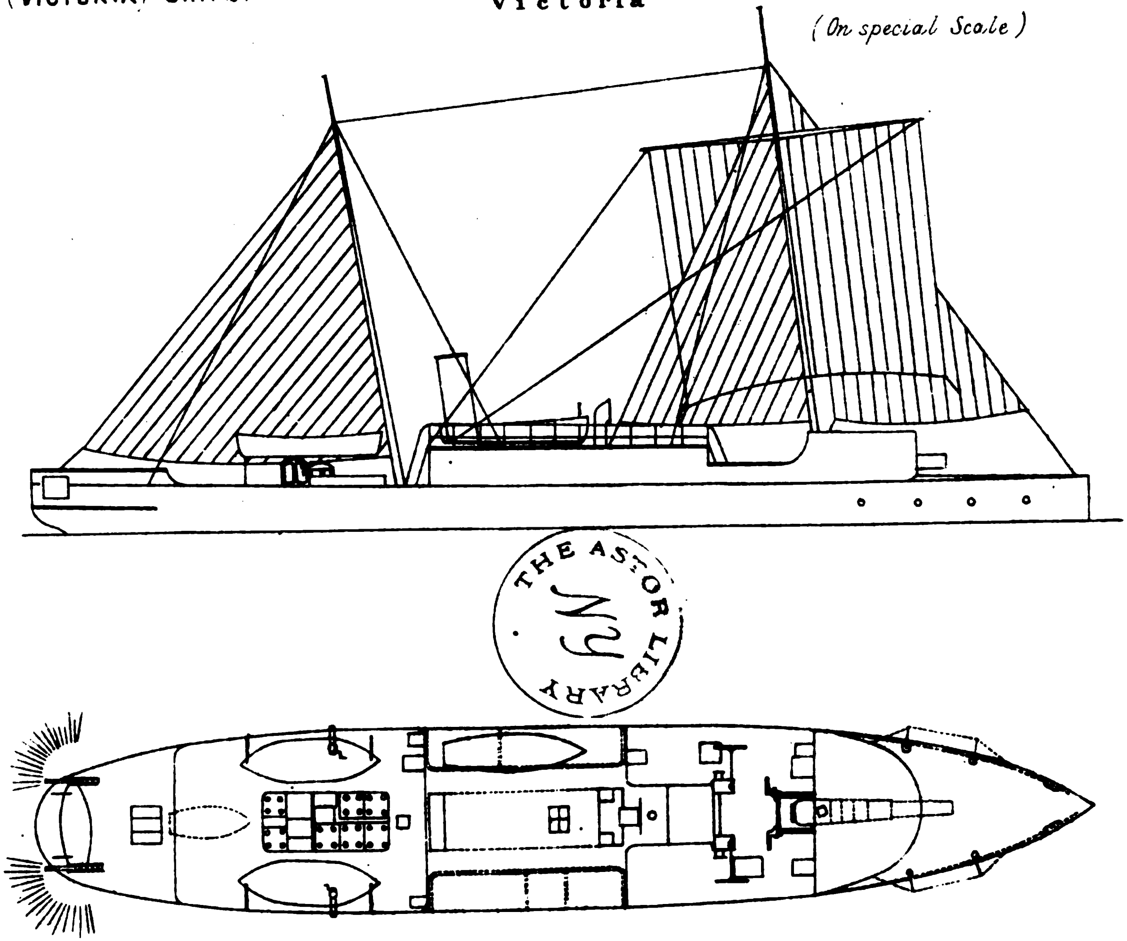


Pl. 42.

BRITISH COLONIAL (VICTORIA) SHIPS.

"Victoria"

(On special Scale)

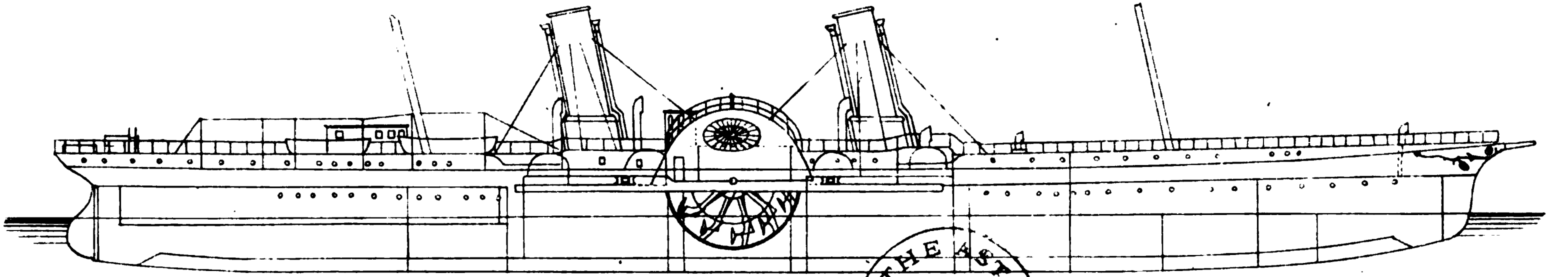


THE ASTOR LIBRARY NY

BRITISH MERCHANT SHIPS.

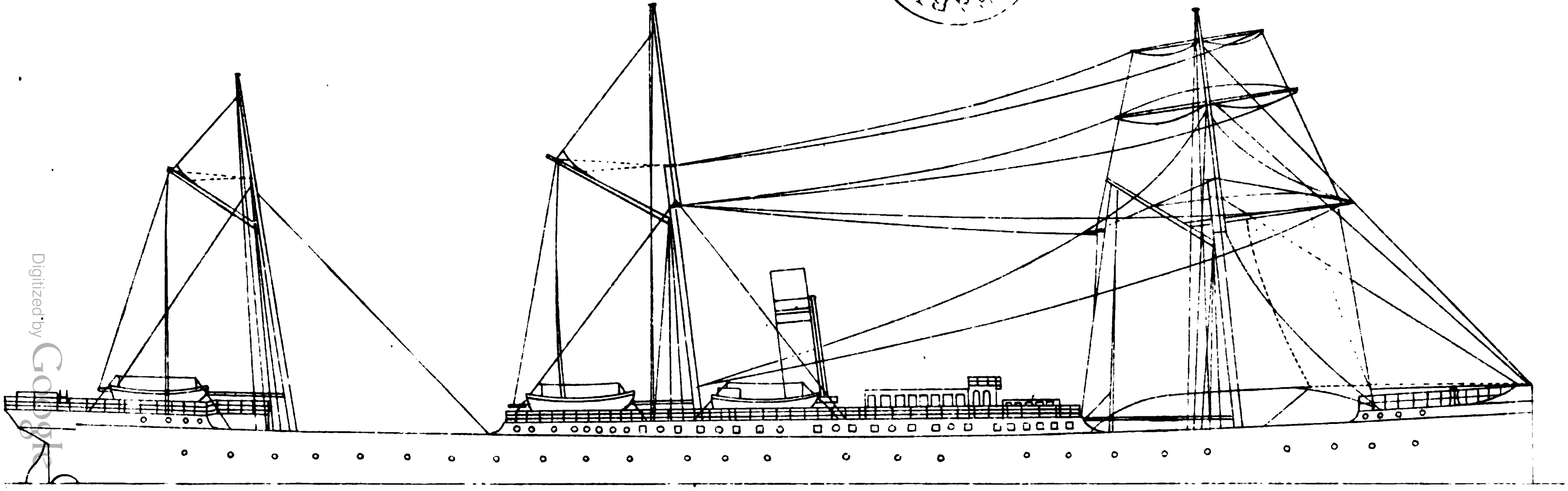
Pl. 43.

Mail Steamer "Ireland".



"Manora".

British India Stm. Nav. Co



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NY

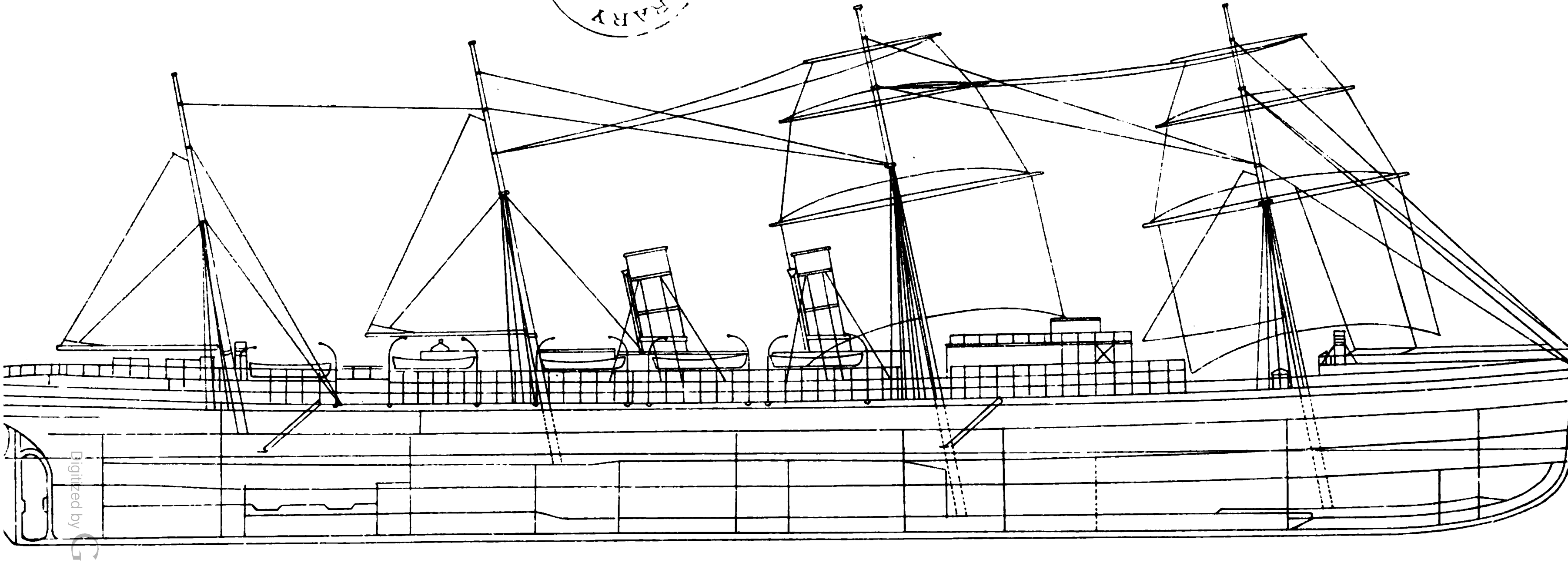
HANHART, LITH

Pl. 44.

BRITISH MERCHANT SHIPS

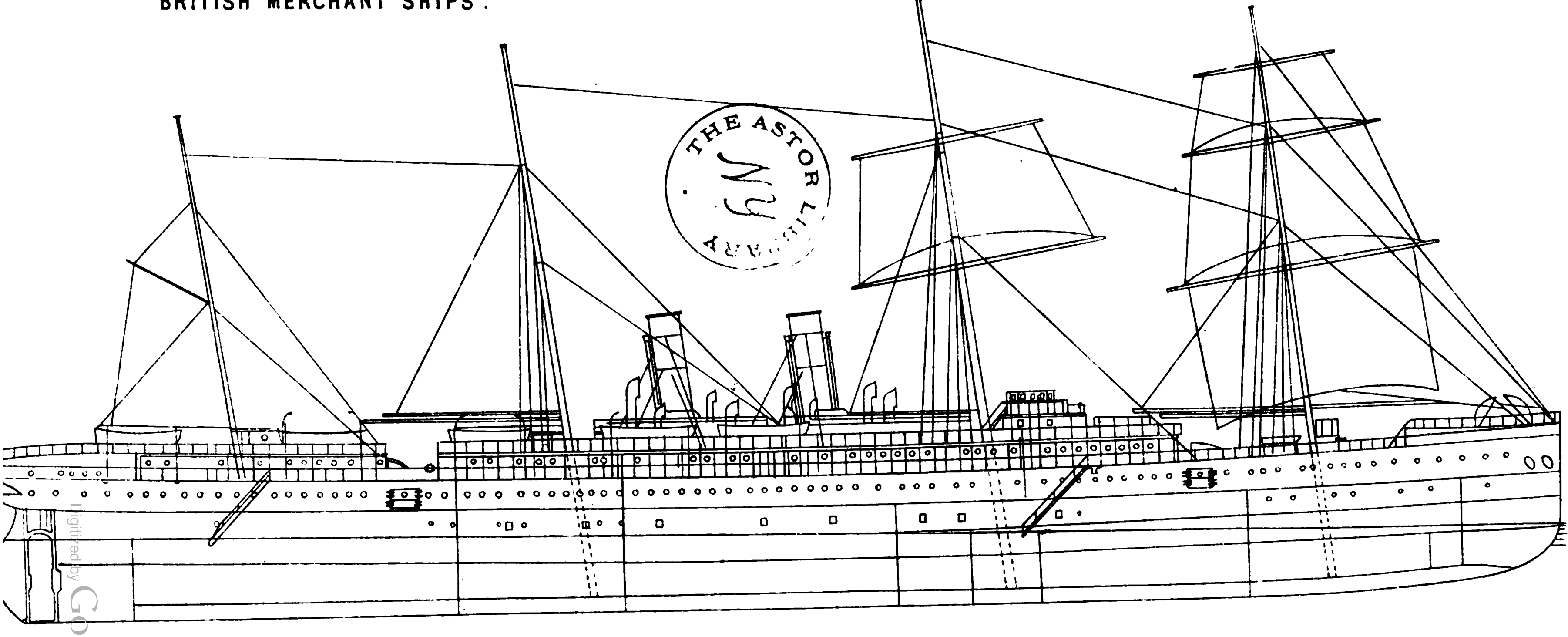
THE ASTOR LIBRARY NY

"Ormuz".
(Orient Steam Navigation Co.)



BRITISH MERCHANT SHIPS.

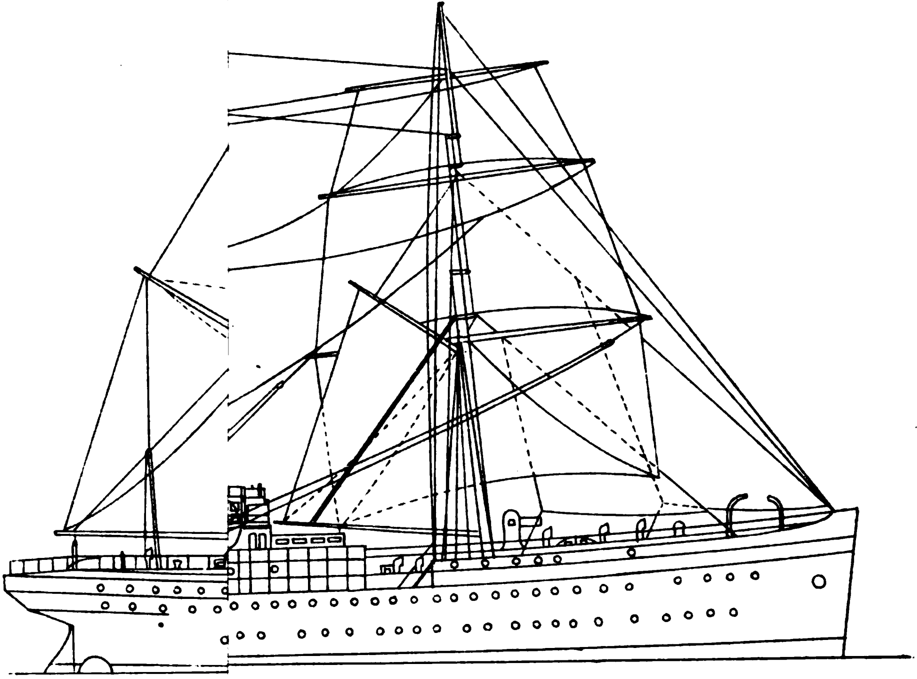
Oroya & Orizaba.

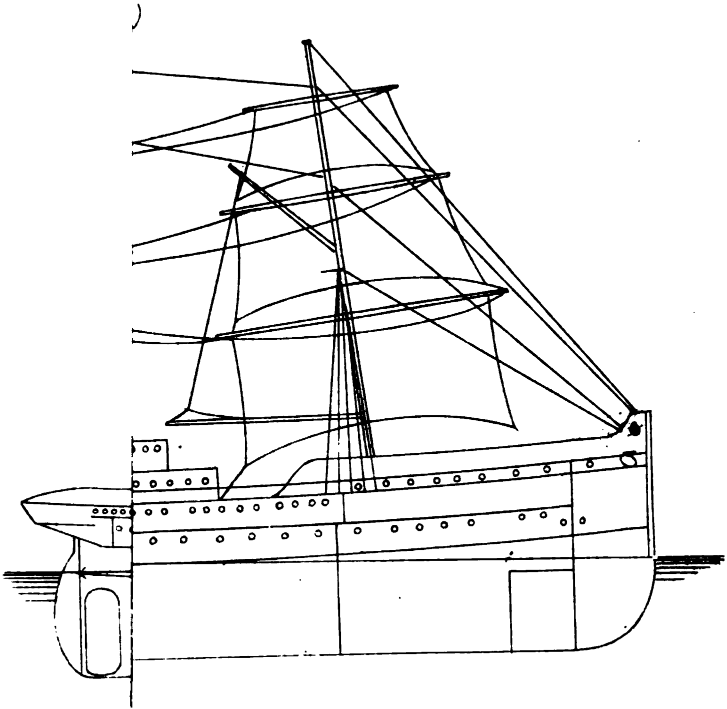


THE ASTOR LIBRARY NY

THE ASTOR LIBRARY
NY

Pl. 46.





HANHART. LITH

THE ASTOR LIBRARY
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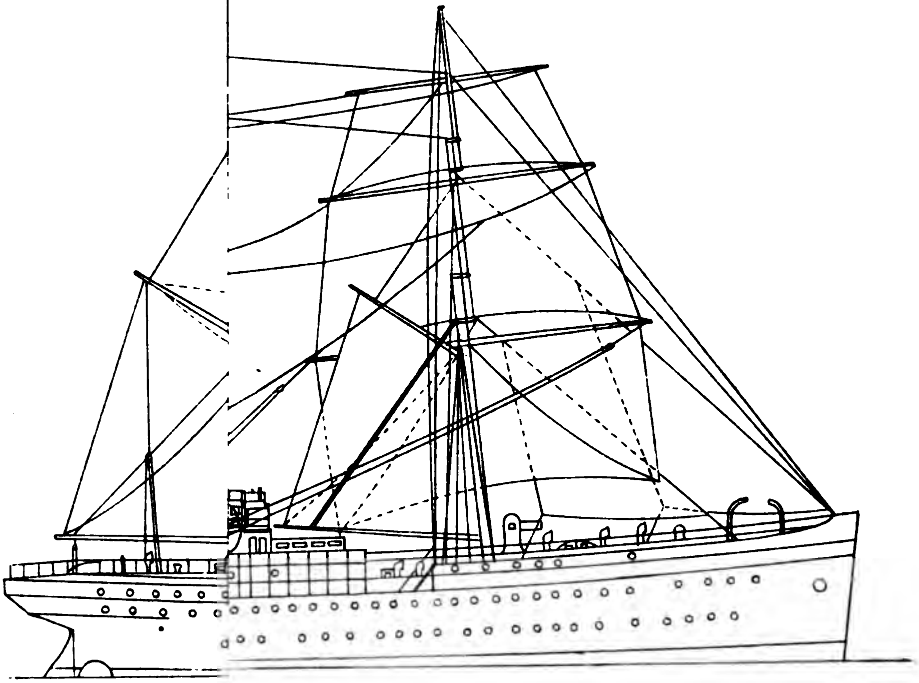
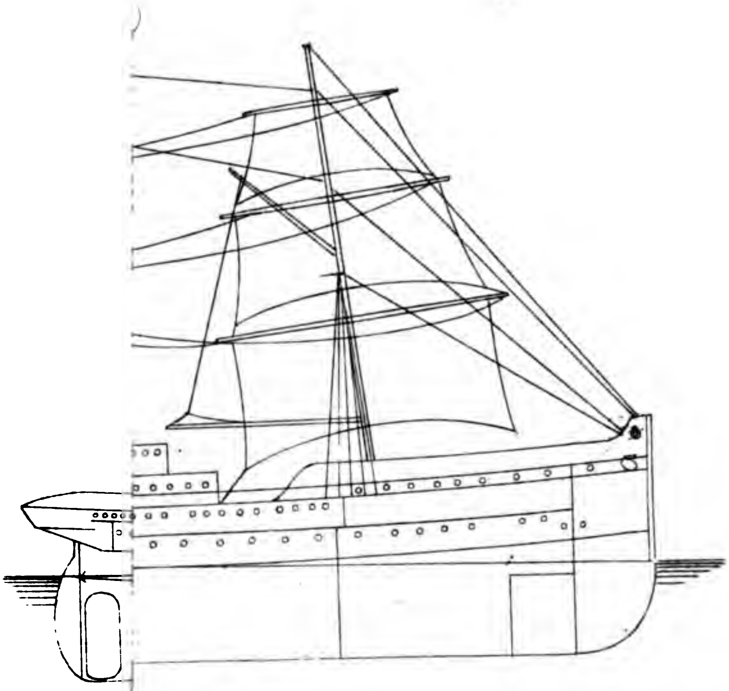
Pl. 40.





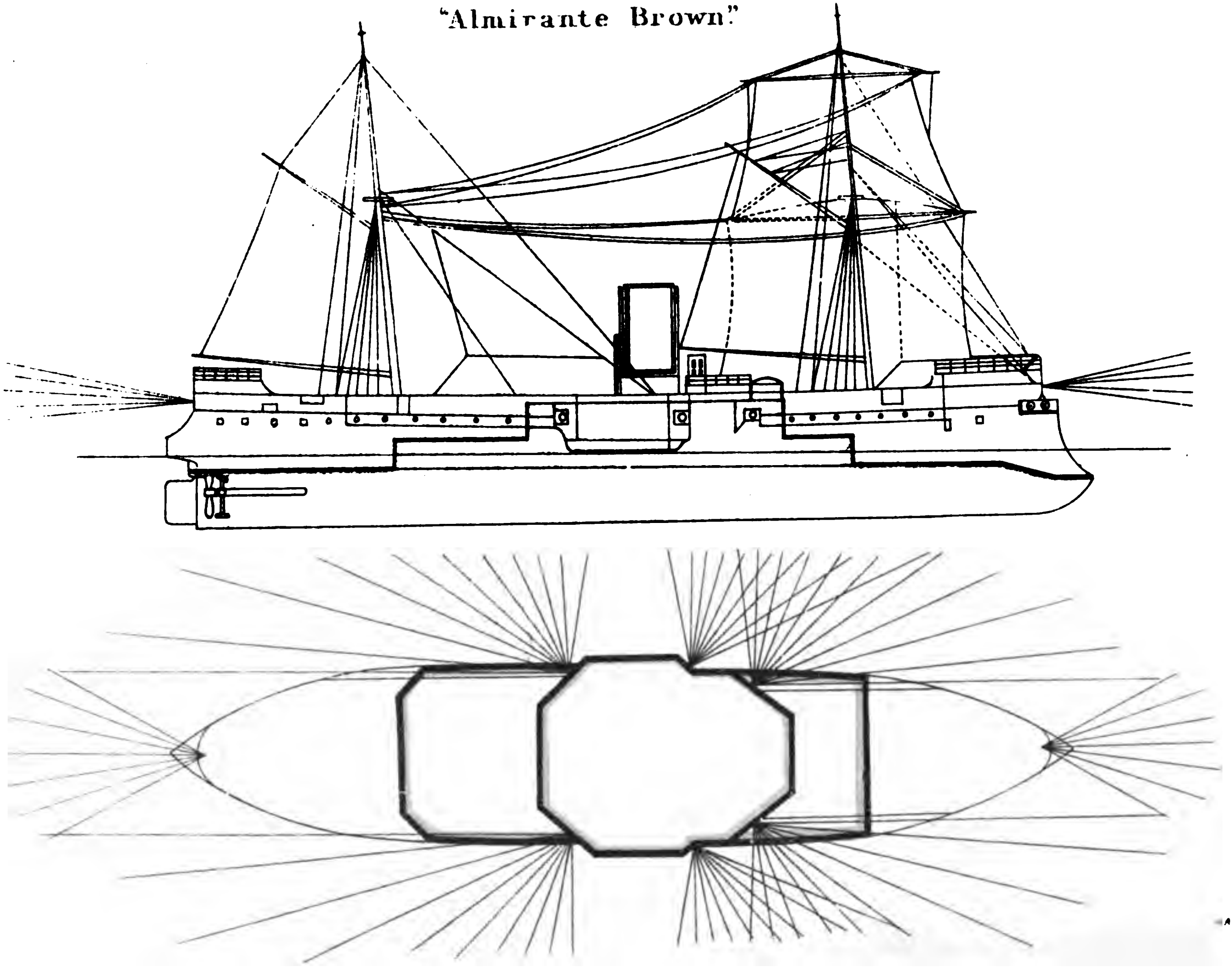
HANNANT LITH

THE AS OR LIBRARY
NY

Pl. 47.

ARGENTINE REPUBLIC SHIPS.

"Almirante Brown."

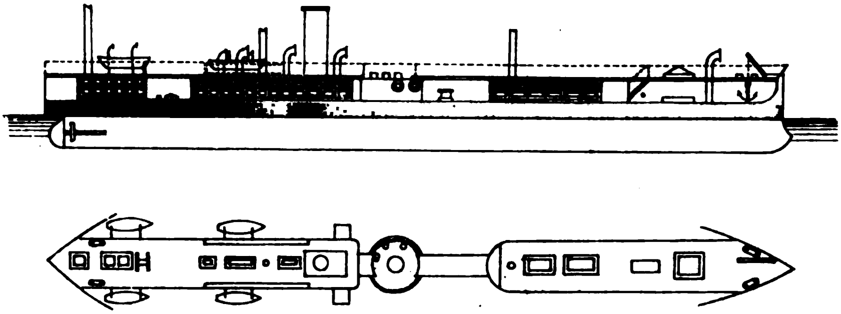


ANHART LITH.

Pl. 48.

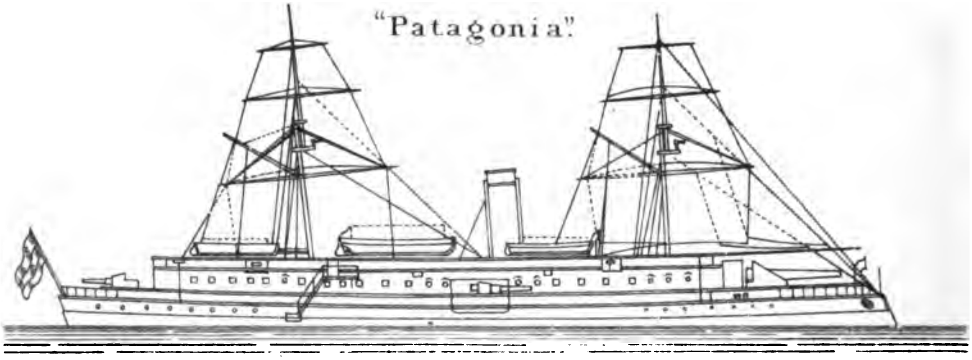
ARGENTINE REPUBLIC SHIPS.

"El Plata" & "Los Andes".



THE ASTOR LIBRARY
N.Y.

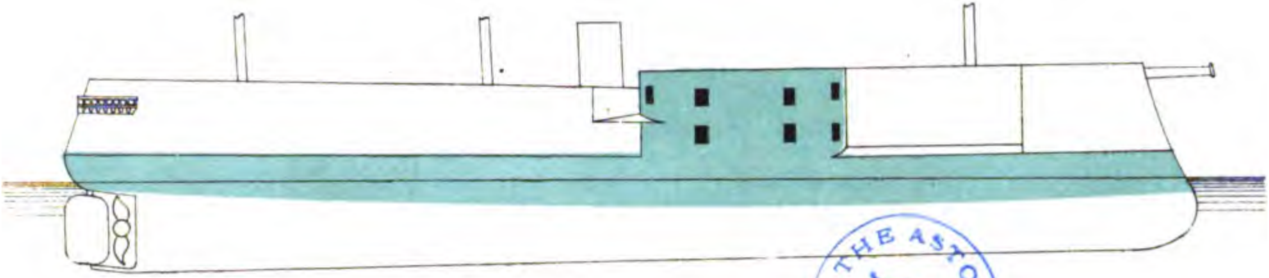
"Patagonia".



Pl. 49.

AUSTRIAN SHIPS.

"Archduke Albert."



THE ASTOR LIBRARY
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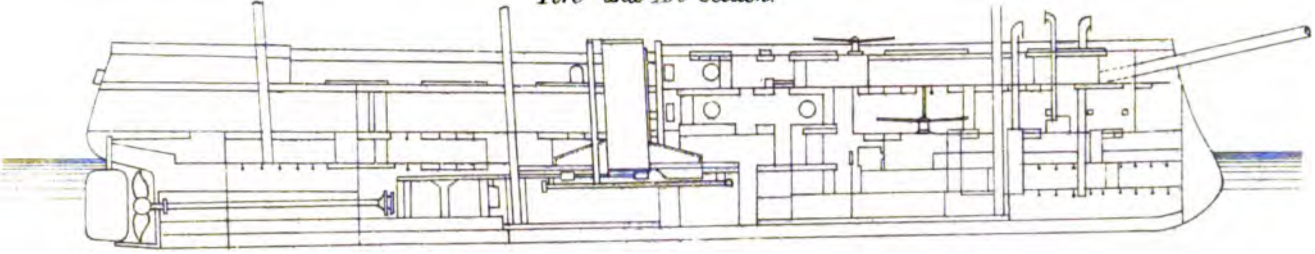
"Archduke Albert"

Fore and Aft Section.

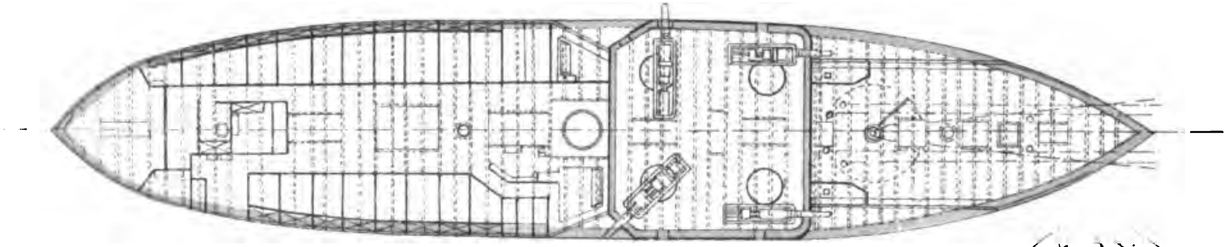


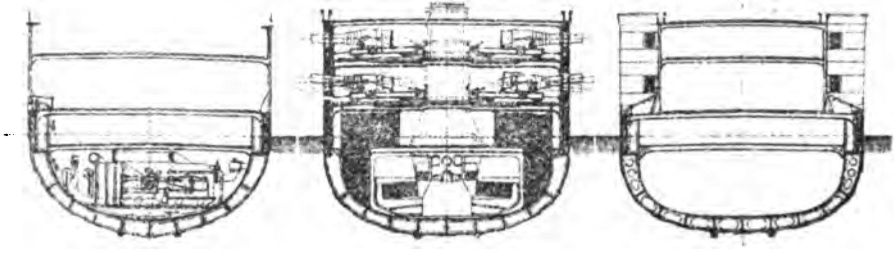
Pl. 50.

AUSTRIAN SHIPS.

"Archduke Albert."

Main Deck.





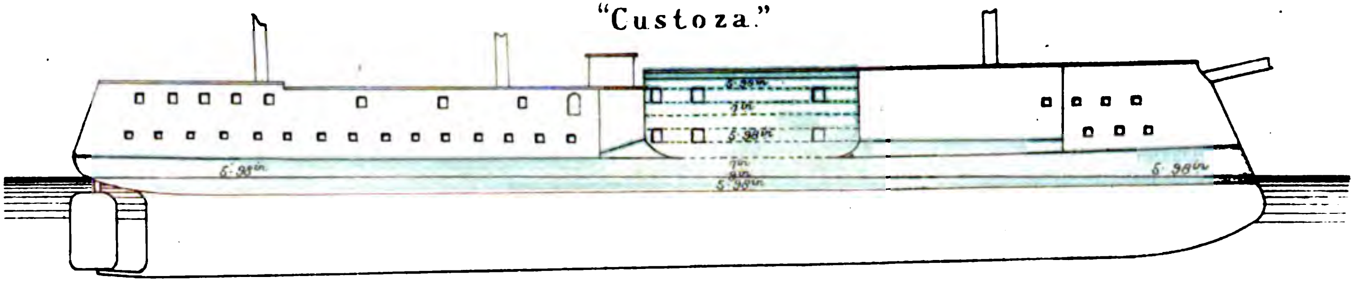
"ARCHDUKE ALBERT" (SECTION).

HANHART LITH

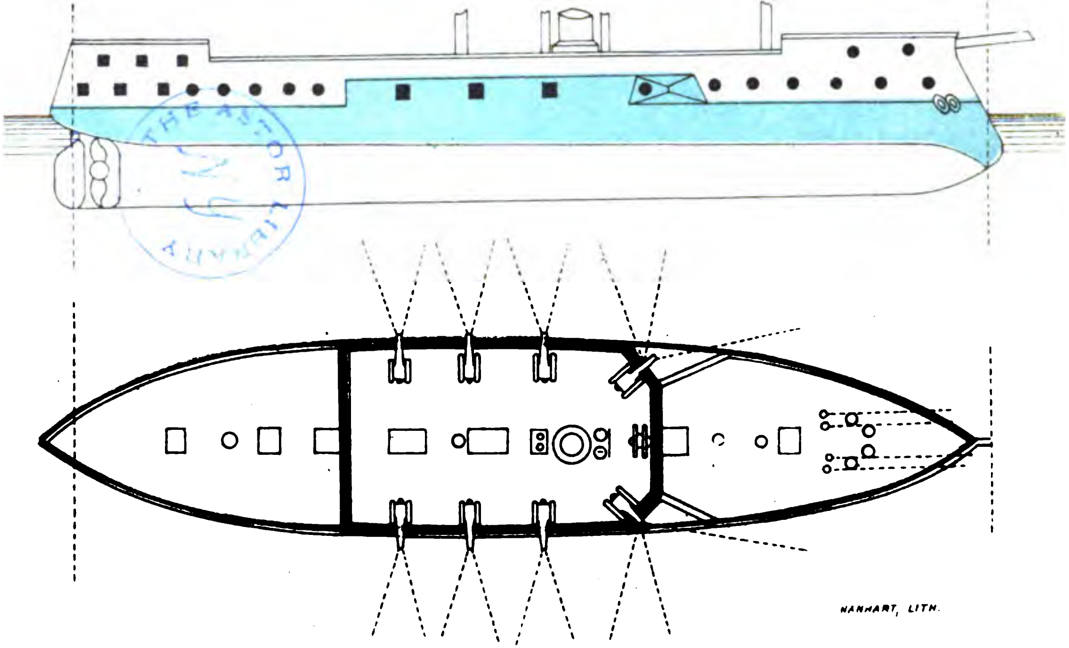
AUSTRIAN SHIPS.

Pl. 51.

"Custoza."

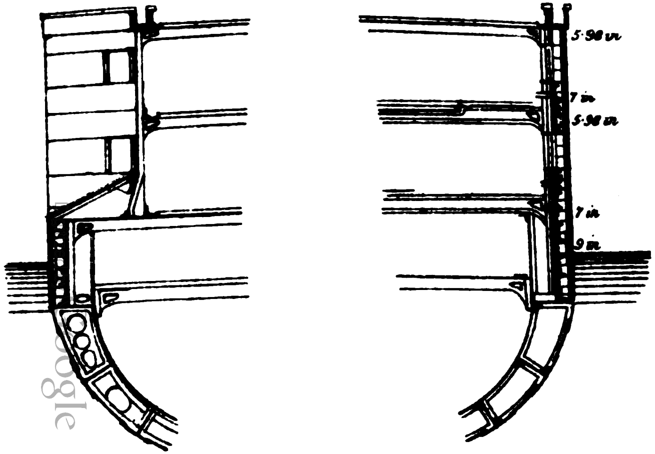


"Don Juan" de Austria.



THE ASTOR LIBRARY N.Y.

"Custoza."



before the Battery.

in the Battery.

HANHART, LITH.

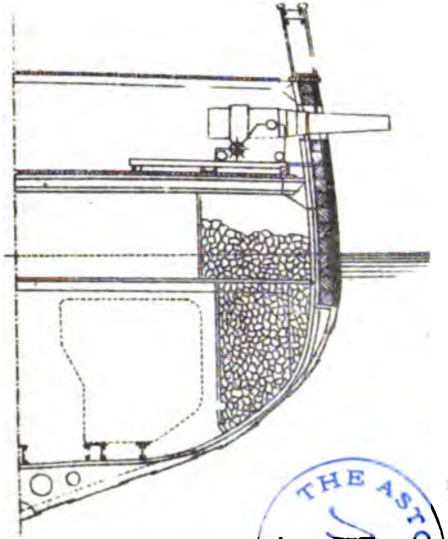
Google

OR LIBRARY

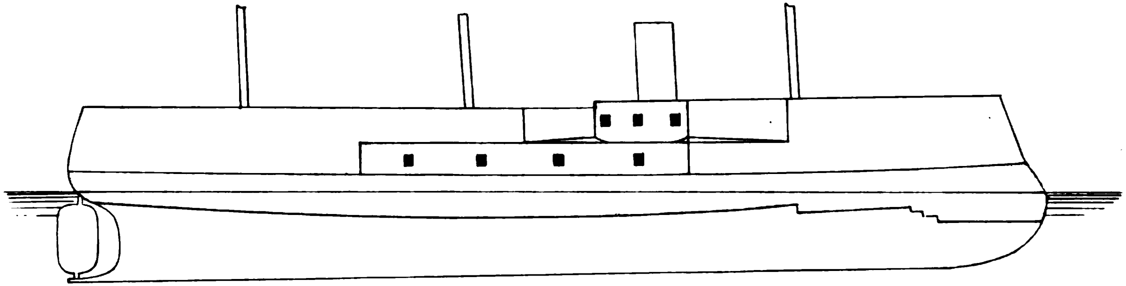
Pl. 52.

AUSTRIAN SHIPS.

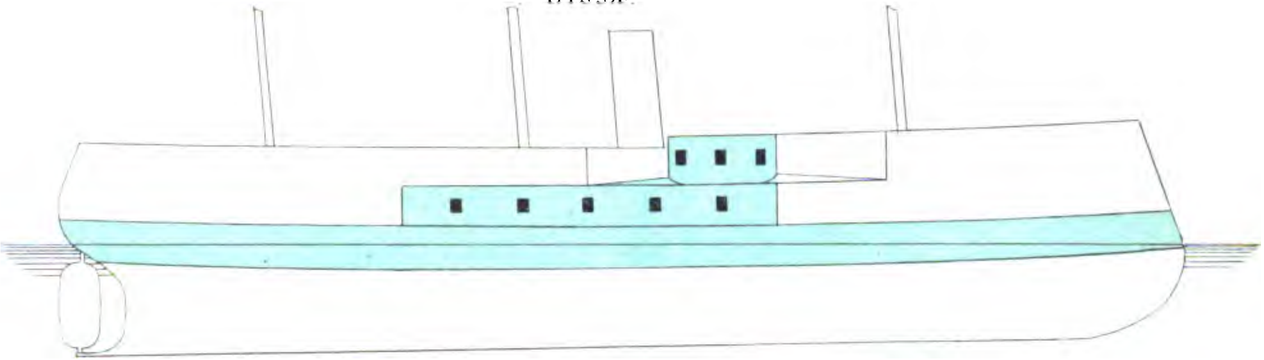
"Don Juan."
Section (as Rebuilt.)



Kaiser.



Lissa.



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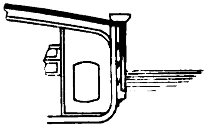
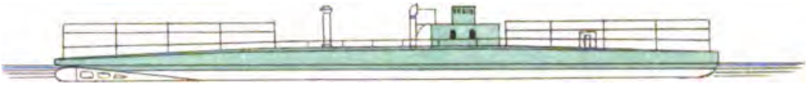
Leitha & Maros (River Monitors



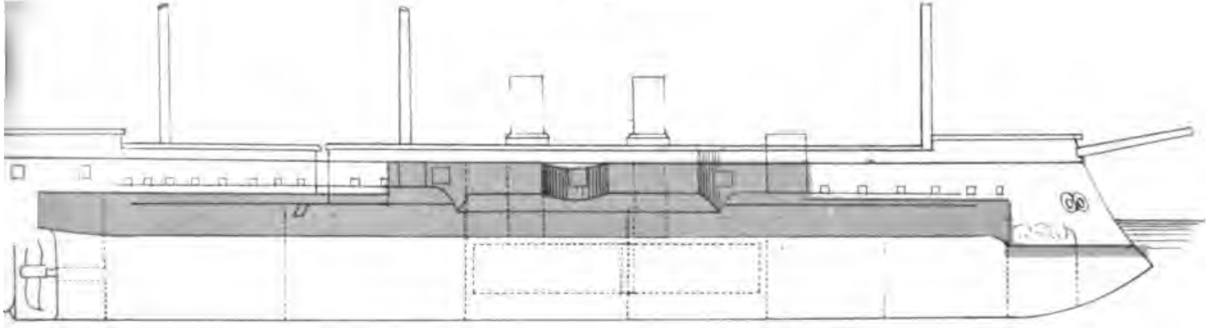


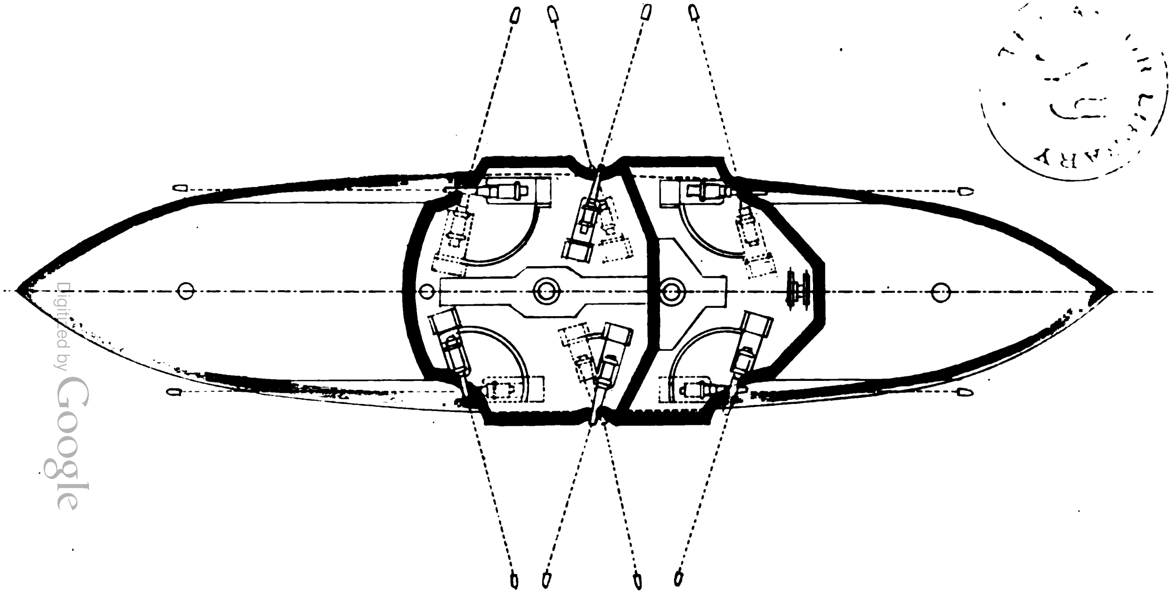
HANHART. LITH

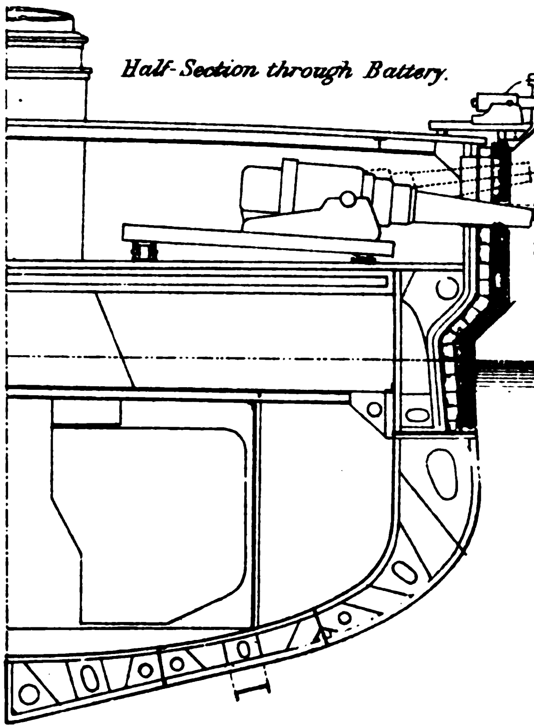
Pl. 53.

AUSTRIAN SHIPS

"Tegetthoff"







Half-Section through Battery.

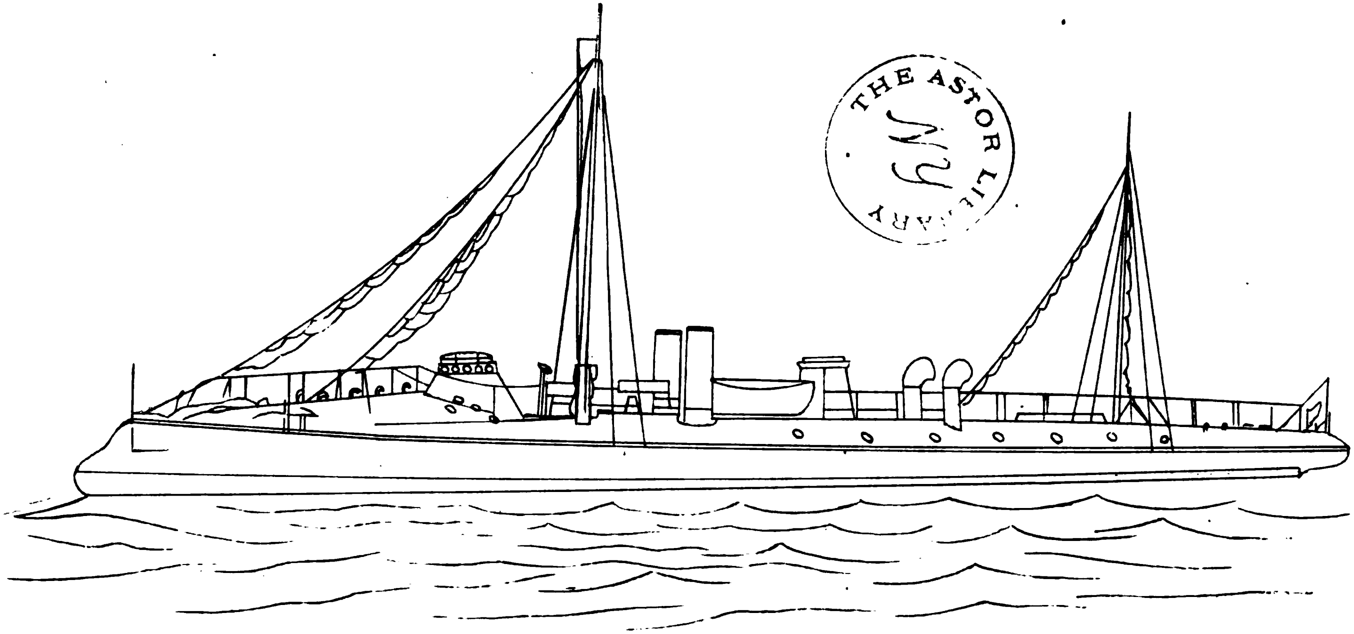
LIBRARY

Pl. 54.

AUSTRIAN SHIP.

"Falke" (Torpedo Boat.)

THE ASTOR LIBRARY
NY



Pl. 55.

THE ASTOR LIBRARY
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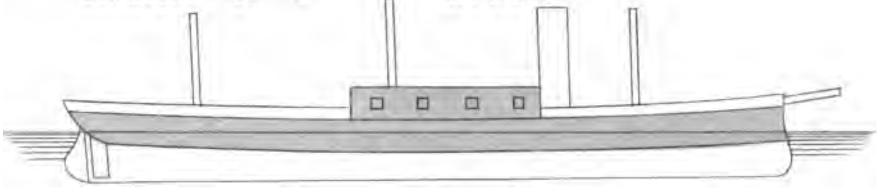
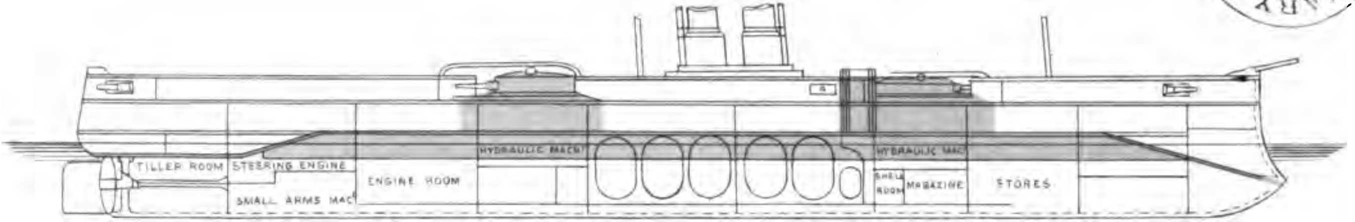
BRAZILIAN SHIPS.

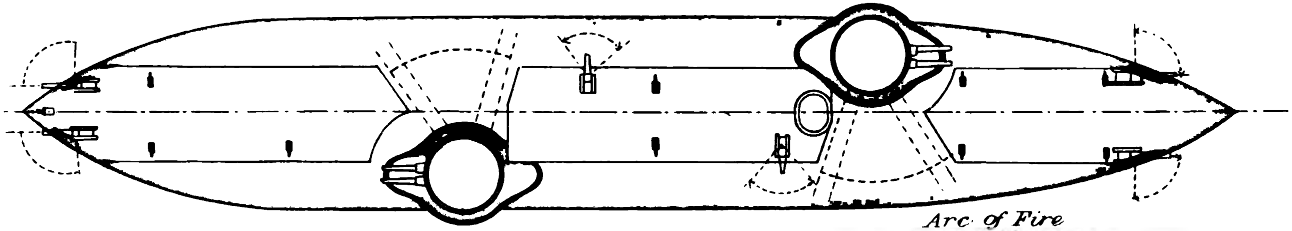
Brazil.



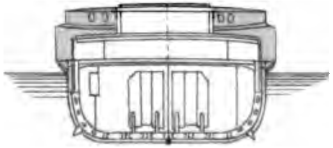
Riachuelo.



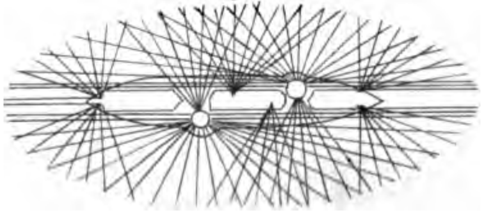
Plan of Upper Deck.



Midship Section



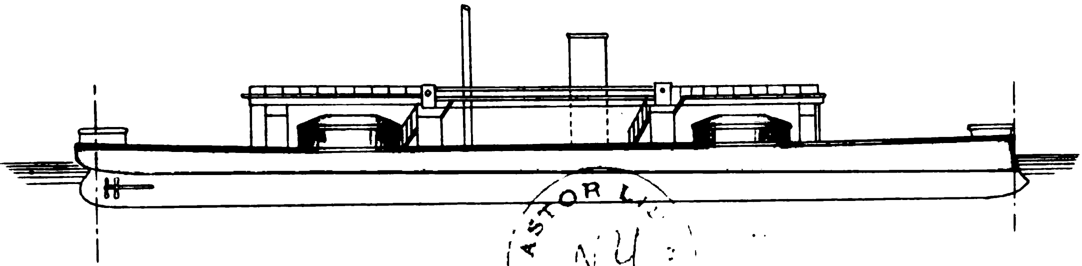
Arc of Fire



HANHART, LITH.

BRAZILIAN SHIPS.

Solimoes & Javary.



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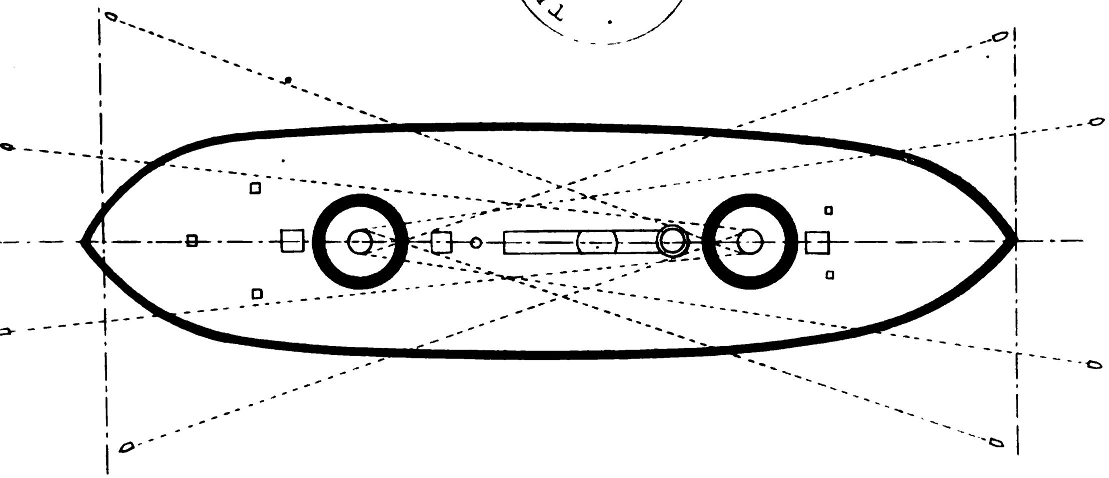
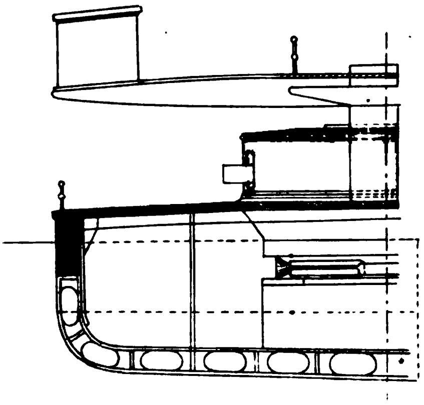
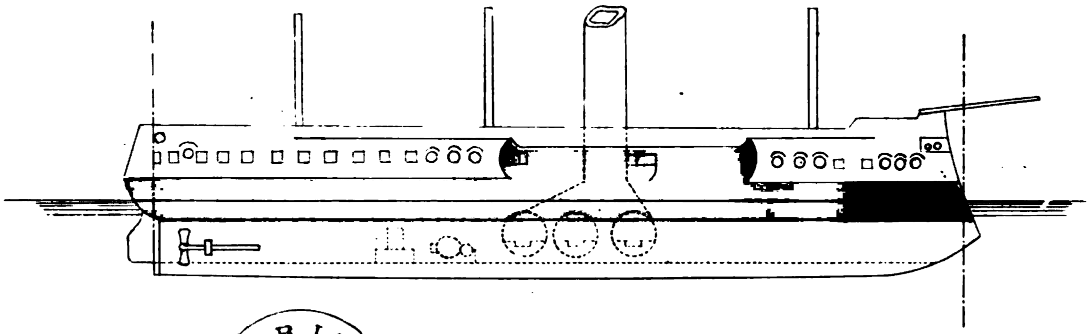


Section.

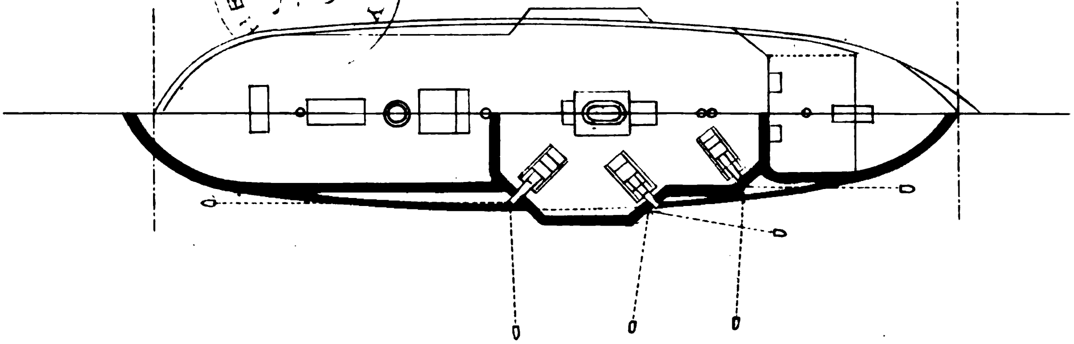


CHILIAN SHIPS.

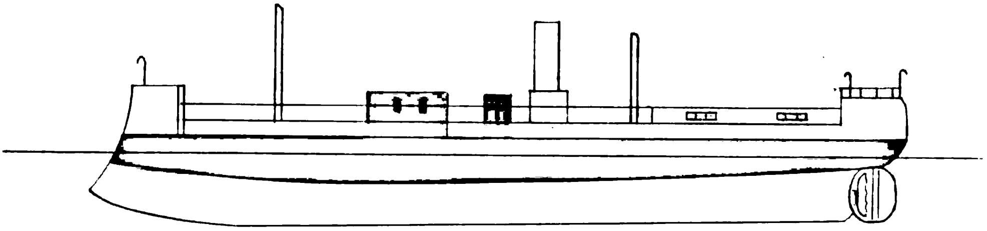
"Almirante Cochrane"
"Blanco Encalada"

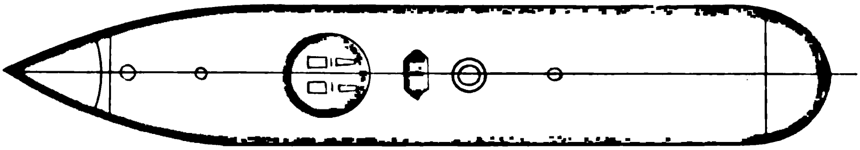


THE ASTOR LIBRARY N.Y.



Huascar.

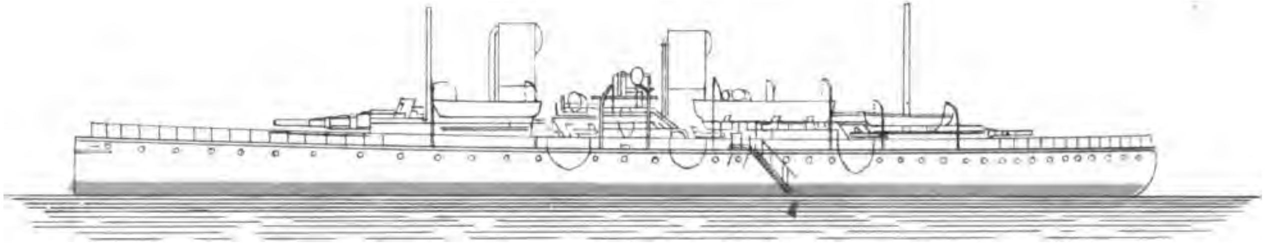




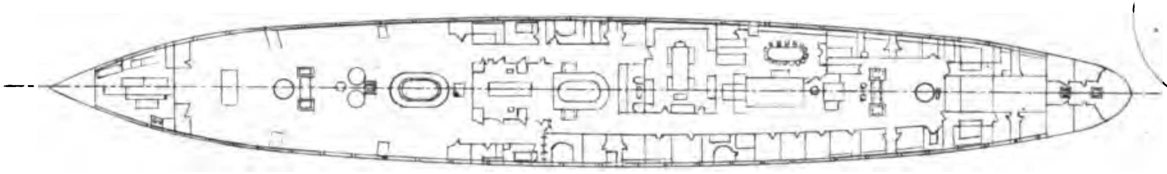
Pl. 58.

CHILIAN SHIPS

"Esmeralda"



Main Deck



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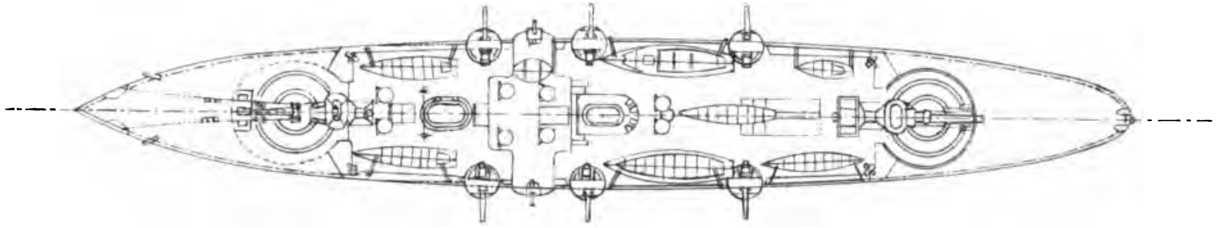
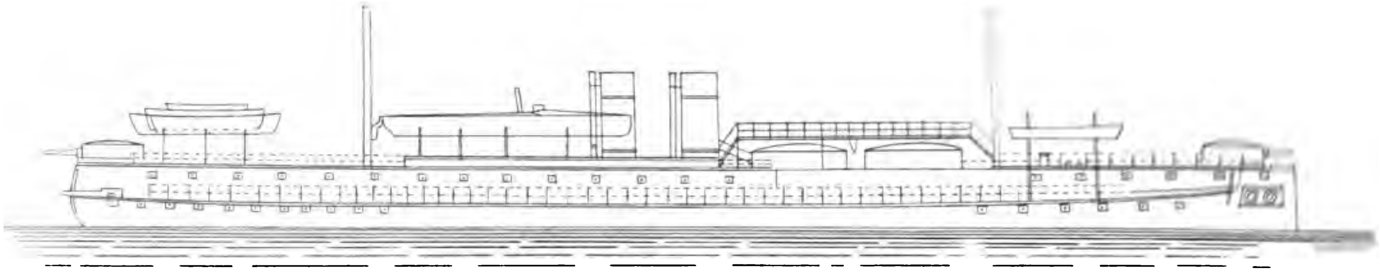
Upper Deck

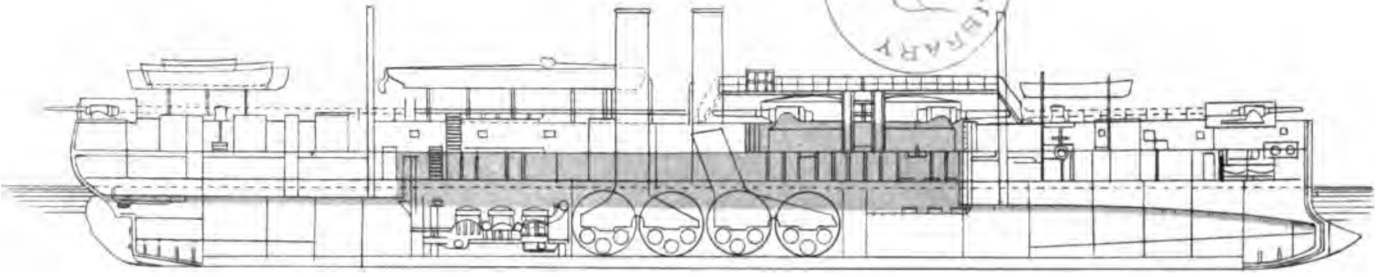


HANHART LITH

CHINESE NAVY

"Ting Yuen" & "Chen Yuen"





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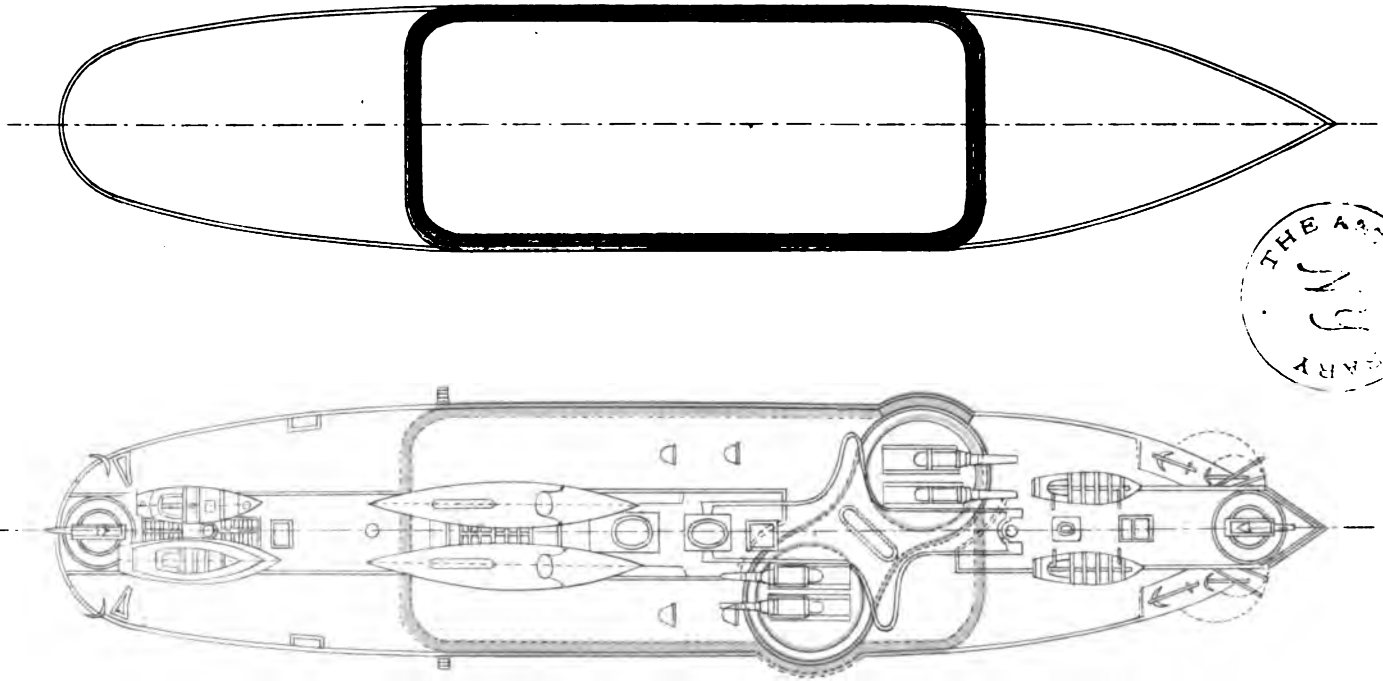
HANNHART, LITH

9X.60.

CHINESE SHIPS.

"Ting Yuen" & "Chen Yuen"



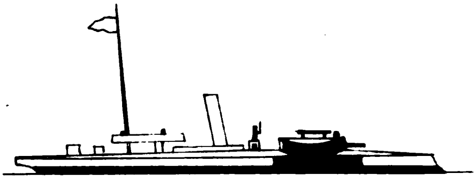
THE ASTOR LIBRARY

HANHART. LITH

Pl. 61.

CHINESE SHIPS

"Tion-Sing".



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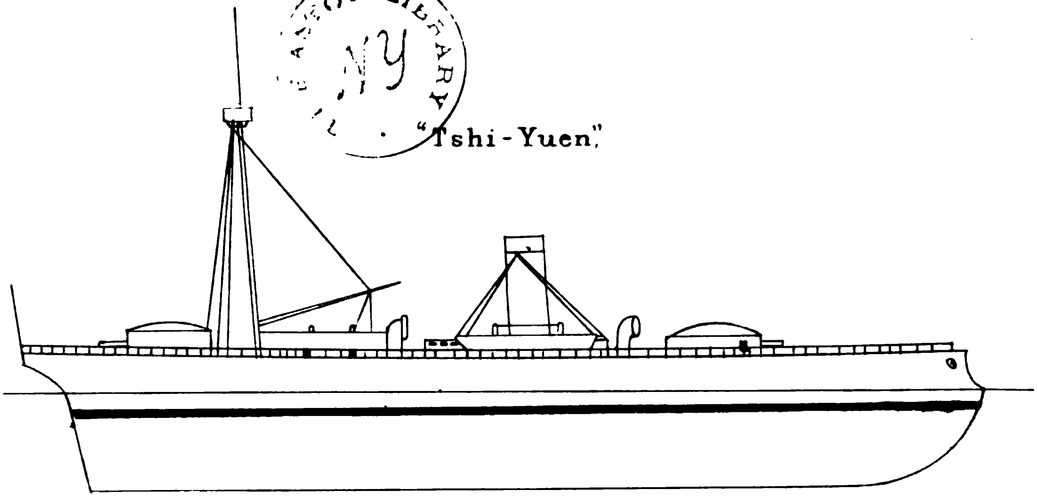
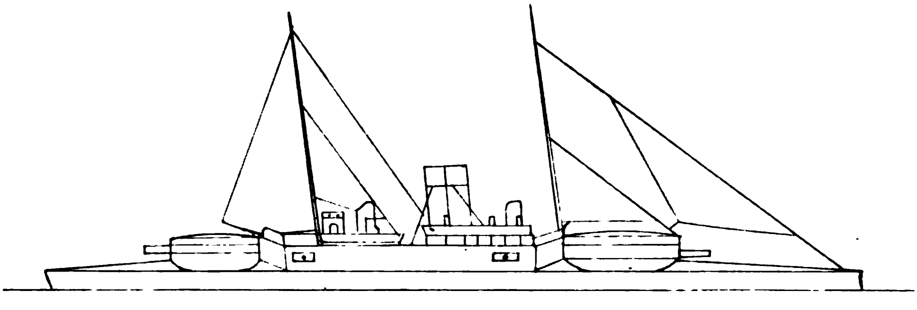
"Tshi-Yuen".



"Tshao-Yong"



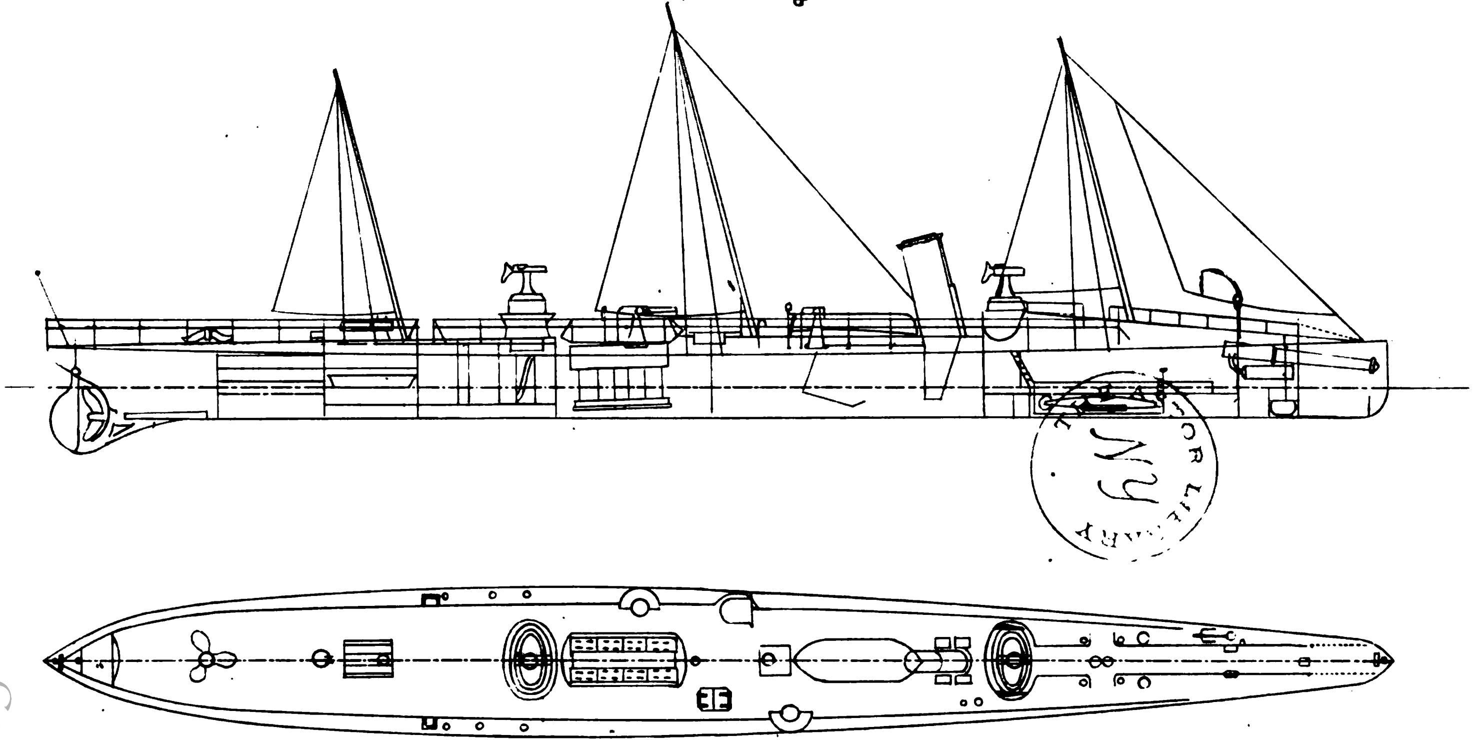
HANNHART LITH.

CHINESE SHIPS

"Sea Going Torpedo Boat."

Built at Ebbing.

On Special Scale



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ANHART LITH

No 63

DANISH SHIPS.

"Helgoland".

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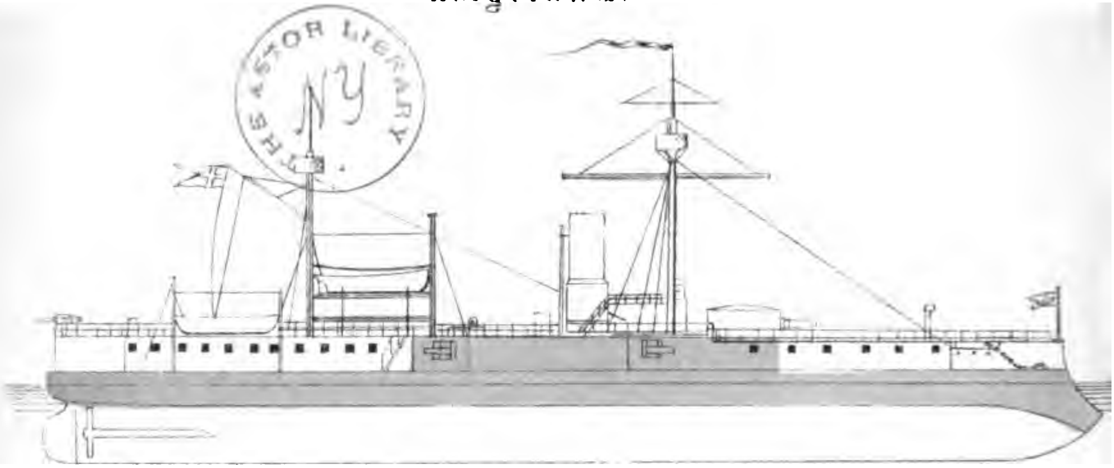
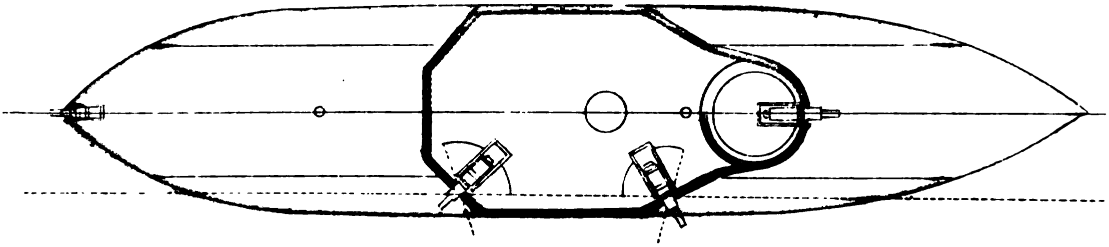
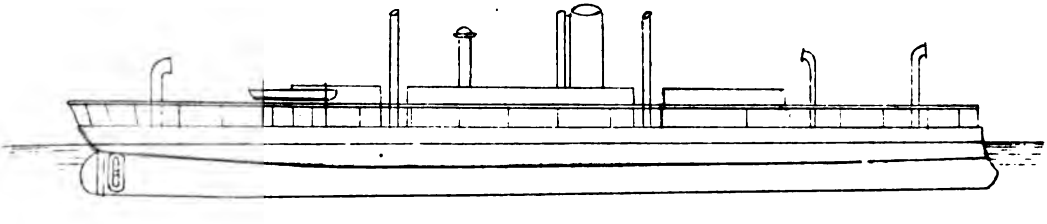




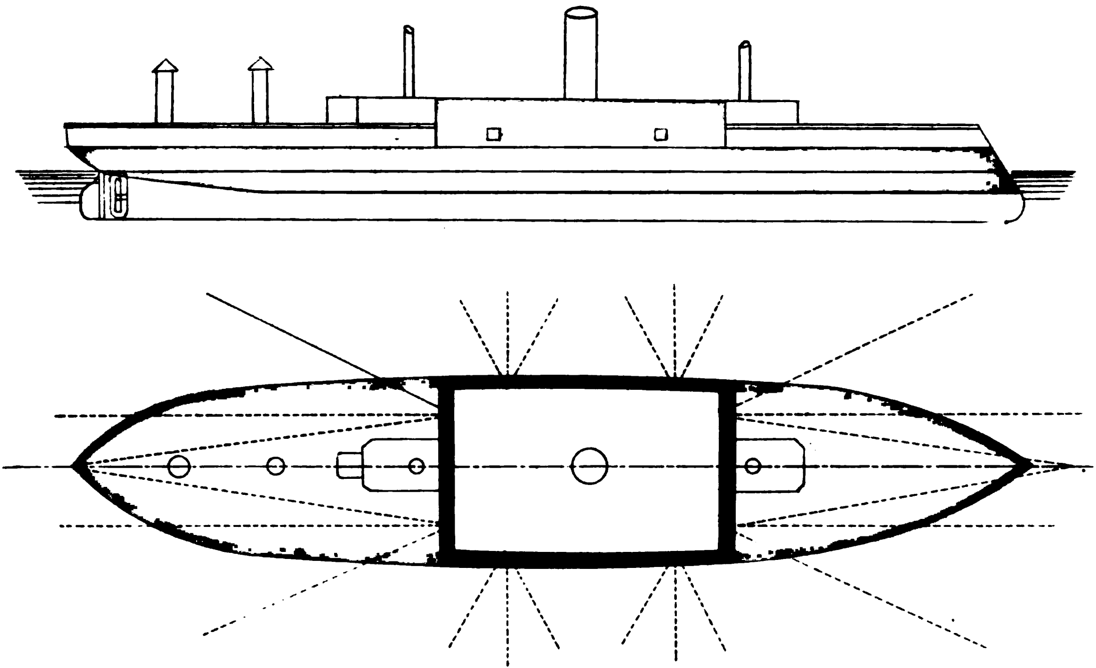
"Gorm".



DANISH SHIPS.

Pl. 64.

"Odin."



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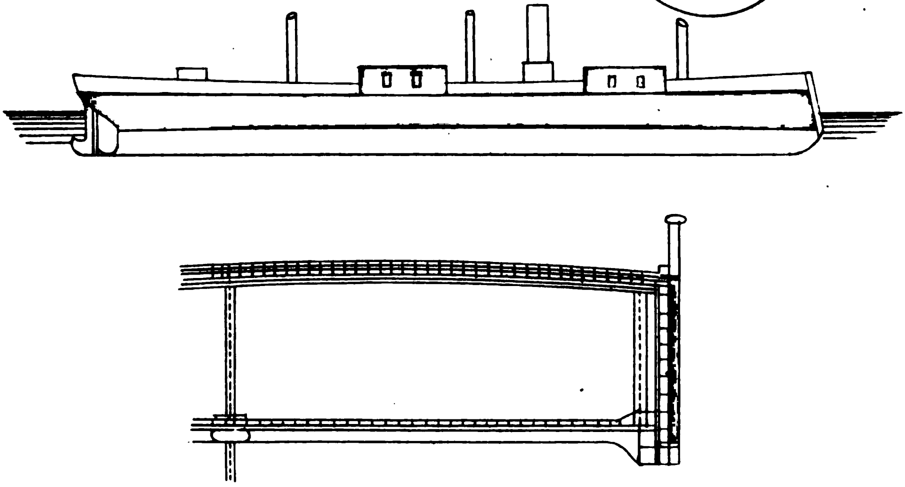
"Rolf Krake"



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FRENCH SHIPS

"Achéron".
"Cocyte".
"Phlegeton".
"Styx".

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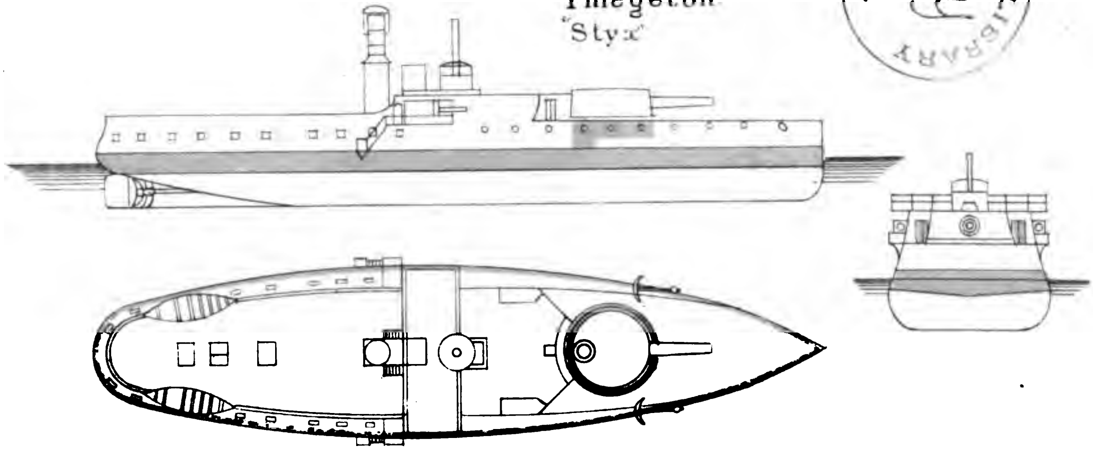

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FRENCH SHIPS.

"Amiral Baudin".

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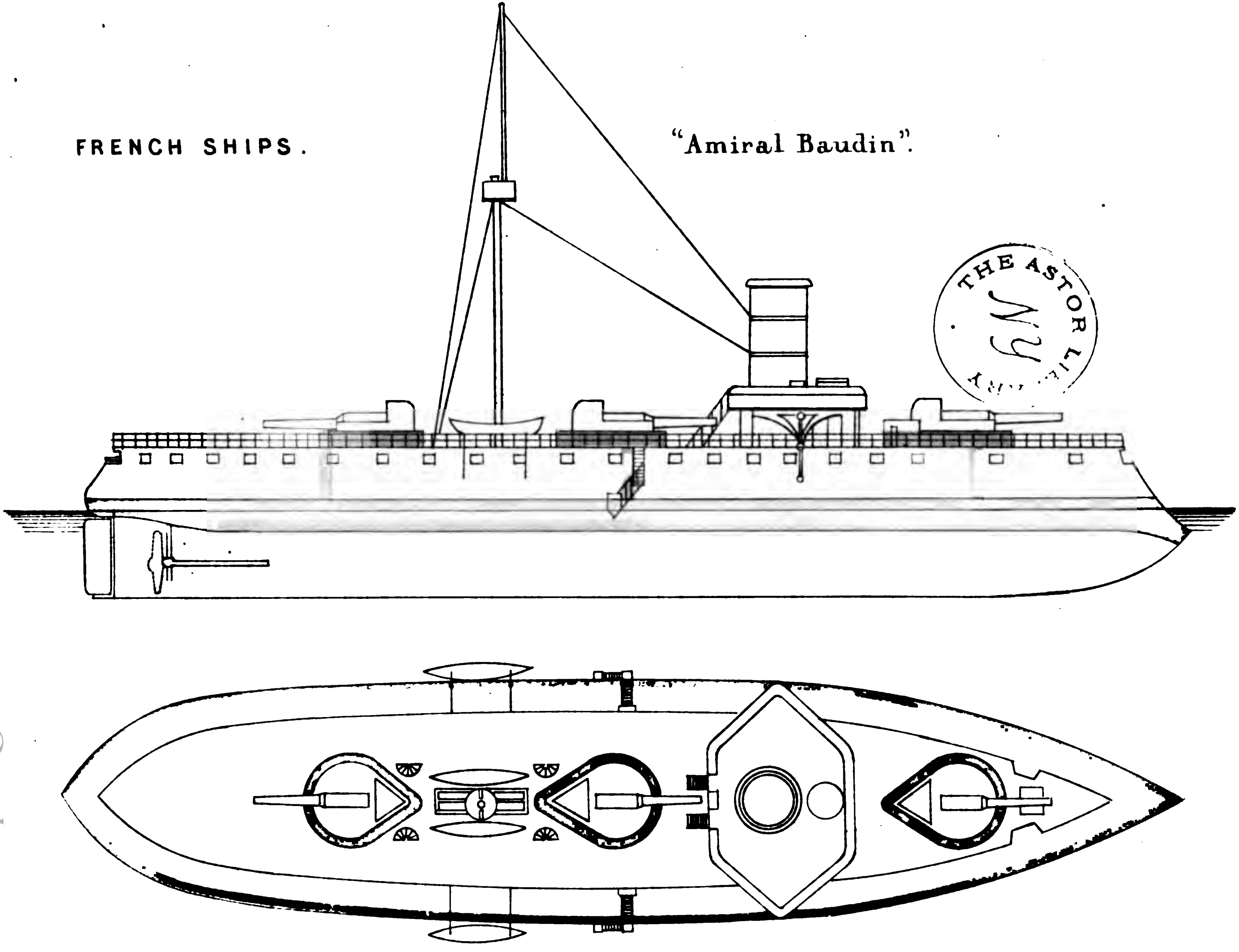
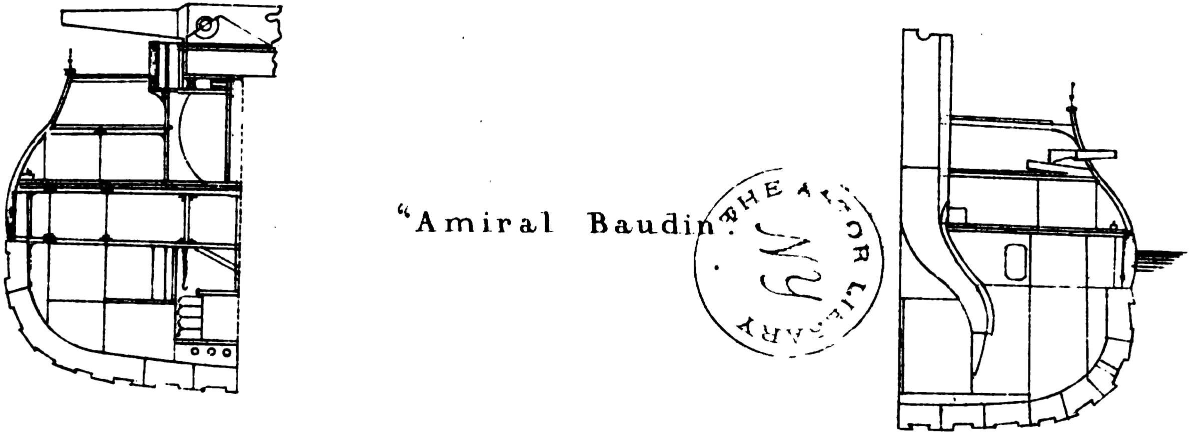


HANHART LITH.

FRENCH SHIPS.

Pl. 67.



"Amiral Baudin".

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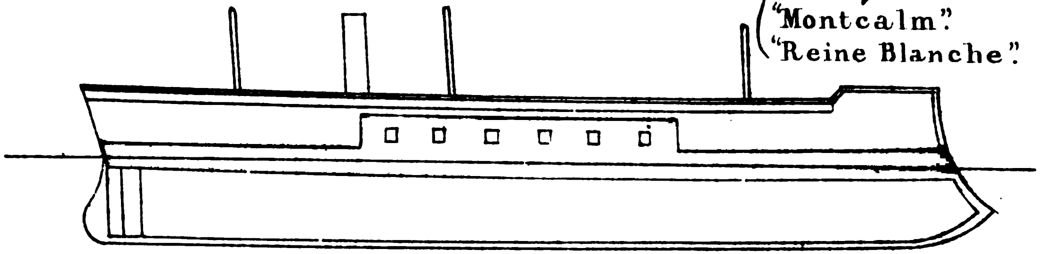
"Belliqueuse". *class*

"Alma".
"Atalante".
"Belliquense".
"Montcalm".
"Reine Blanche".



HANHART LITH.

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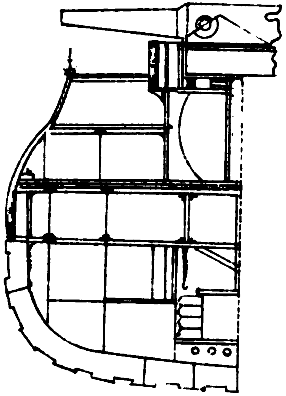
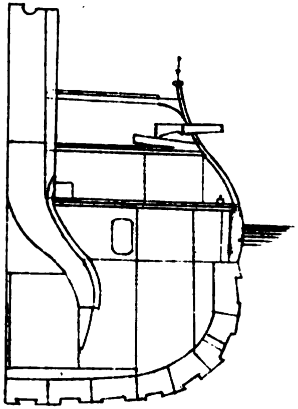
FRENCH SHIPS.





"Amiral Baudin".

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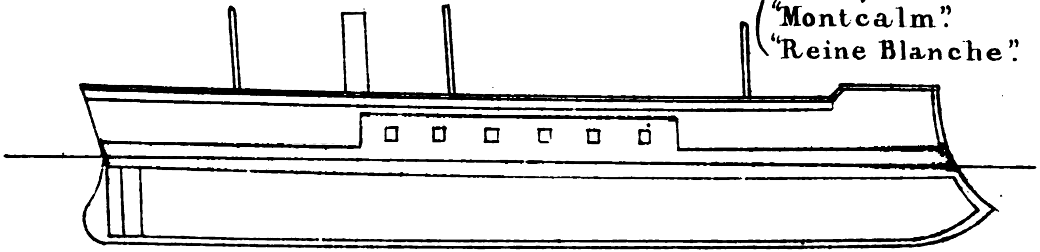
"Belliqueuse" class {
"Alma".
"Atalante".
"Belliquense".
"Montcalm".
"Reine Blanche".



HANHART LITH.

THE
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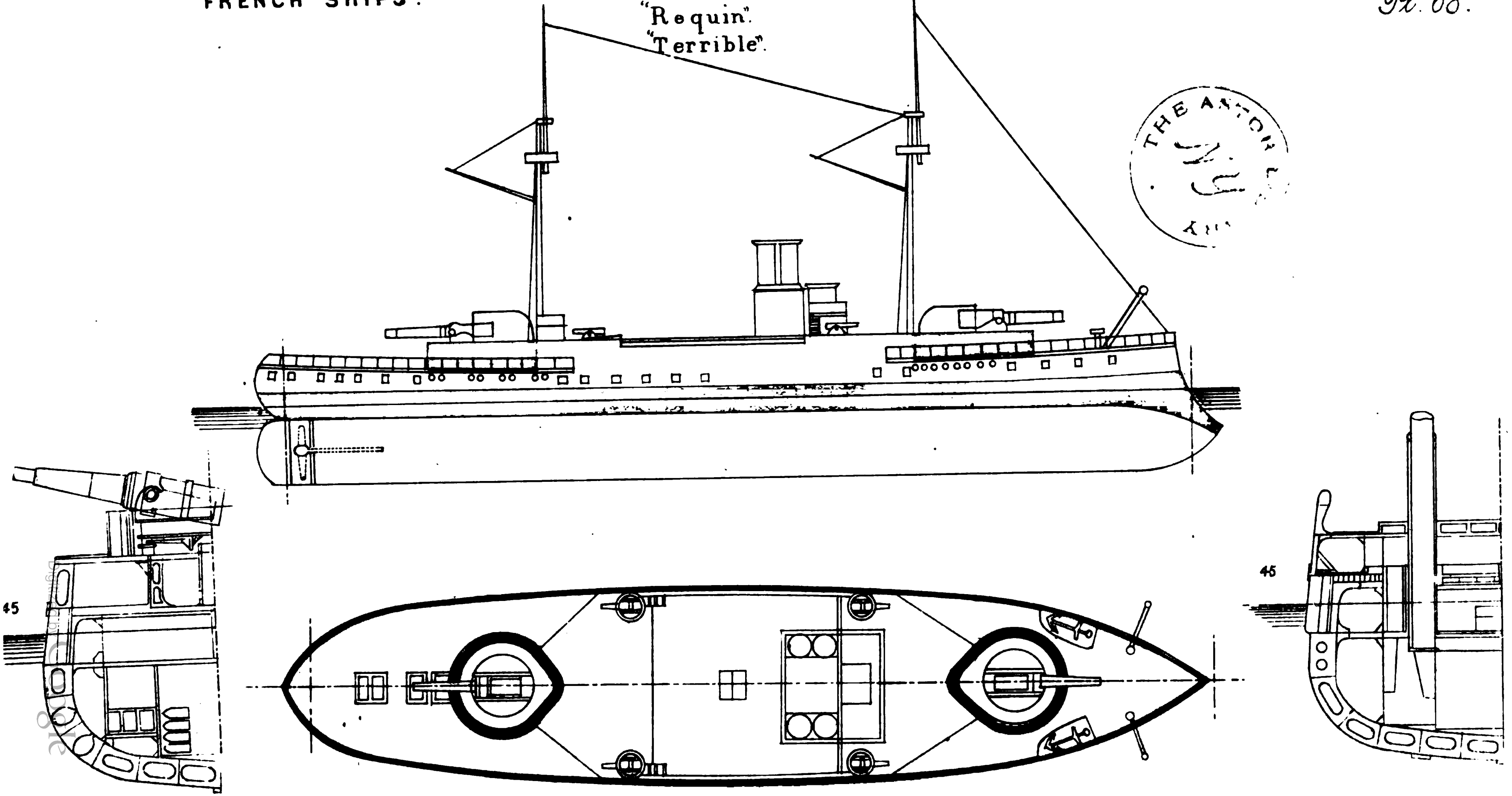
FRENCH SHIPS.

"Caiman".
"Indomptable".
"Requin".
"Terrible".

Pl. 68.

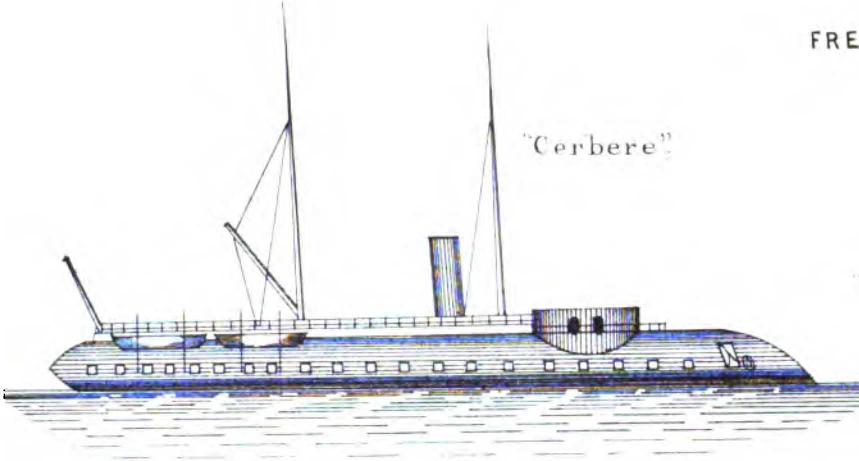


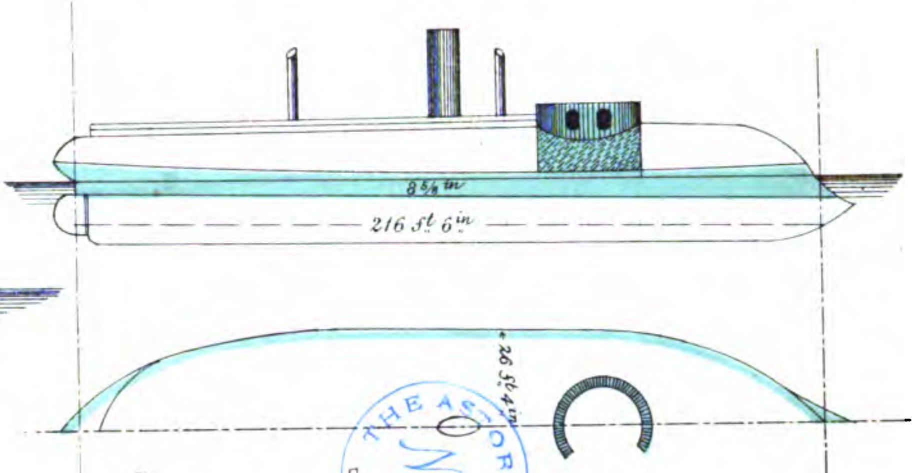
THE ASTOR L
N.Y.

HANHART LITH

FRENCH SHIPS.

"Cerbere".





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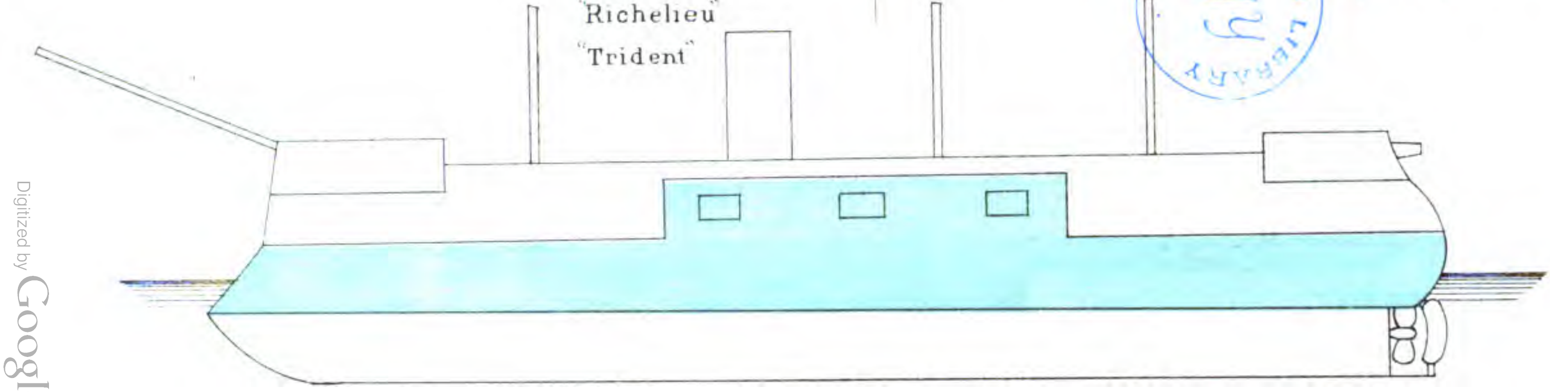
"Colbert"
"Richelieu"
"Trident"



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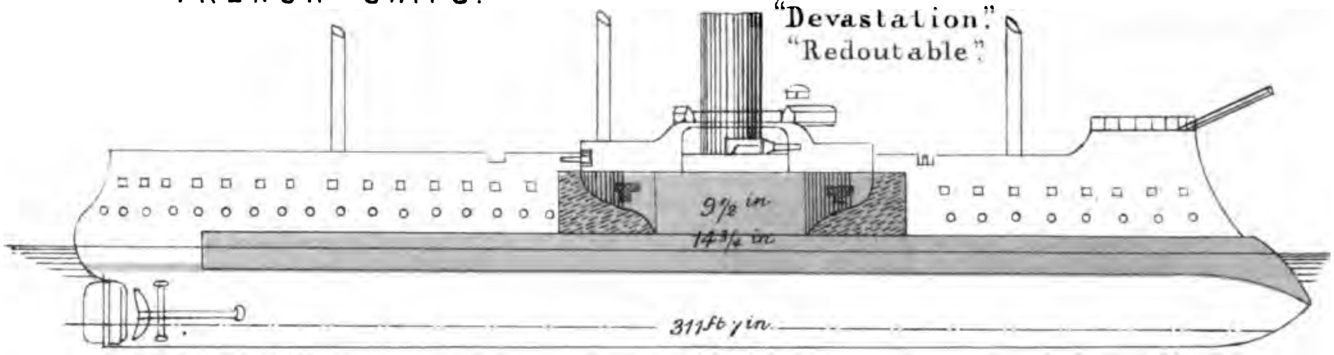
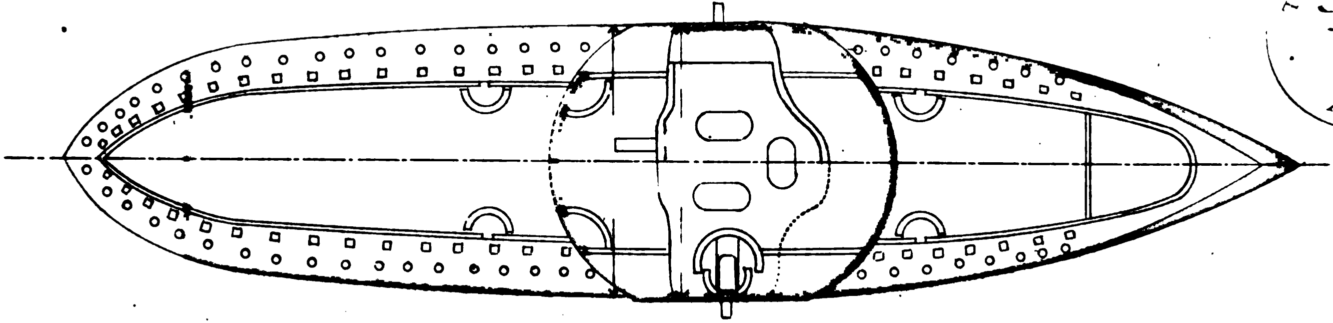
FRENCH SHIPS.

"Courbet."
"Devastation."
"Redoutable."

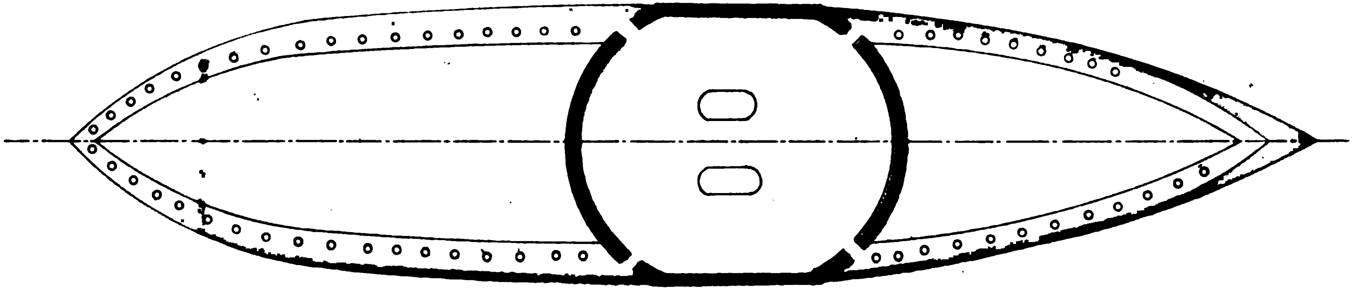
Pl. 70.



Upper Deck.



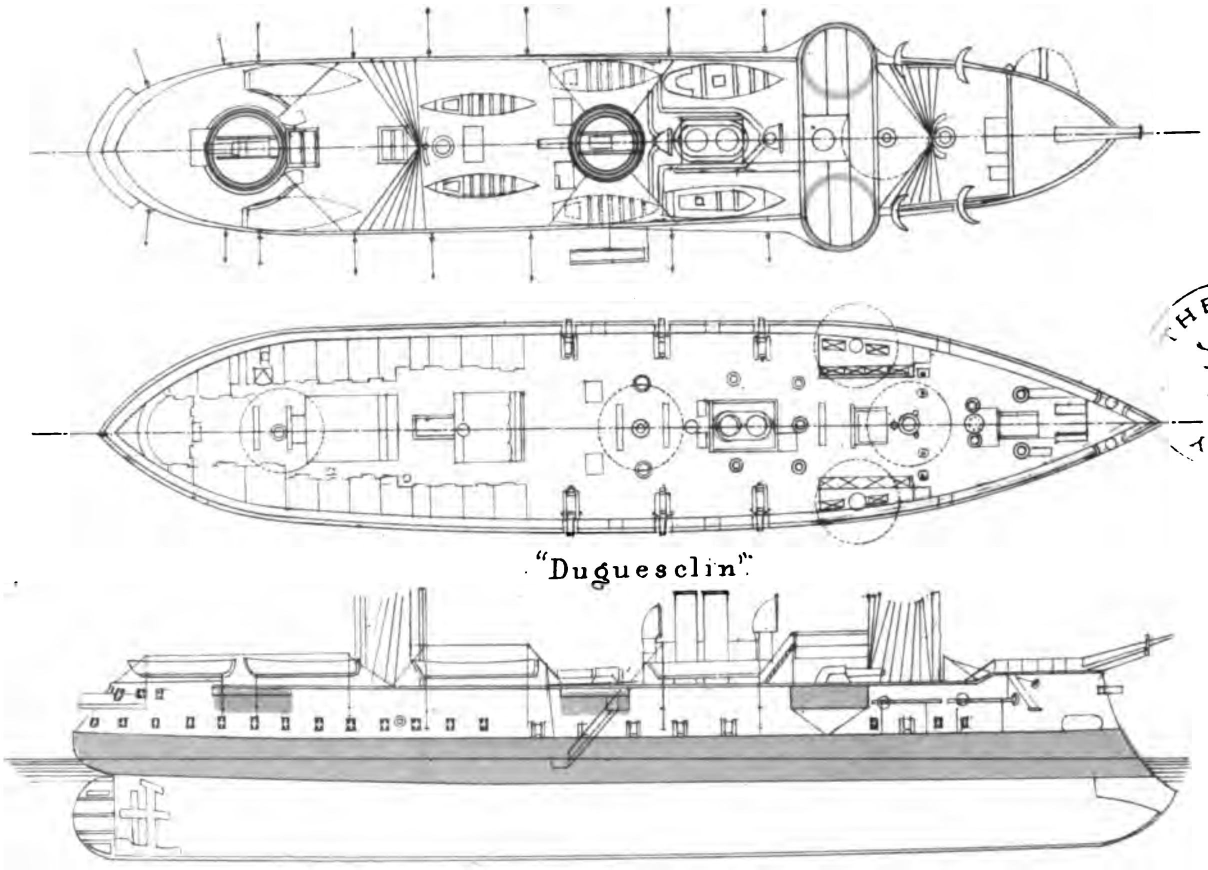
Main Deck.



THE … LIBRARY

HANHART LITH.

FRENCH SHIPS.



"Duguesclin".

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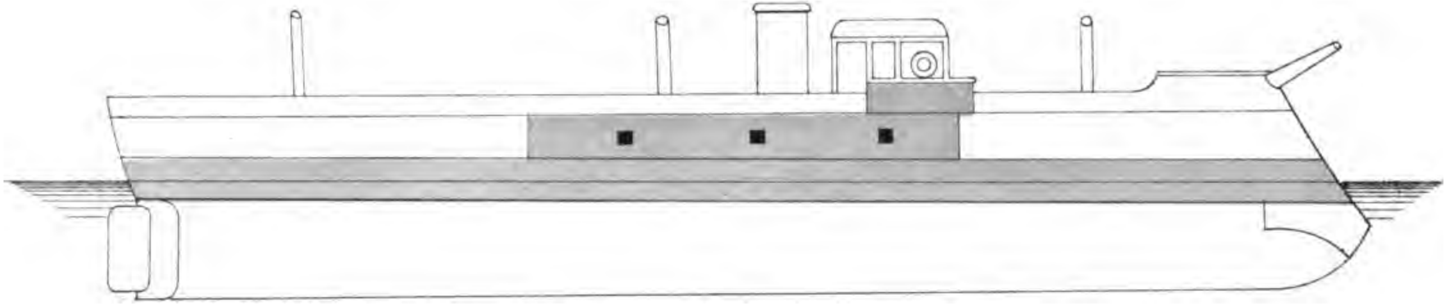
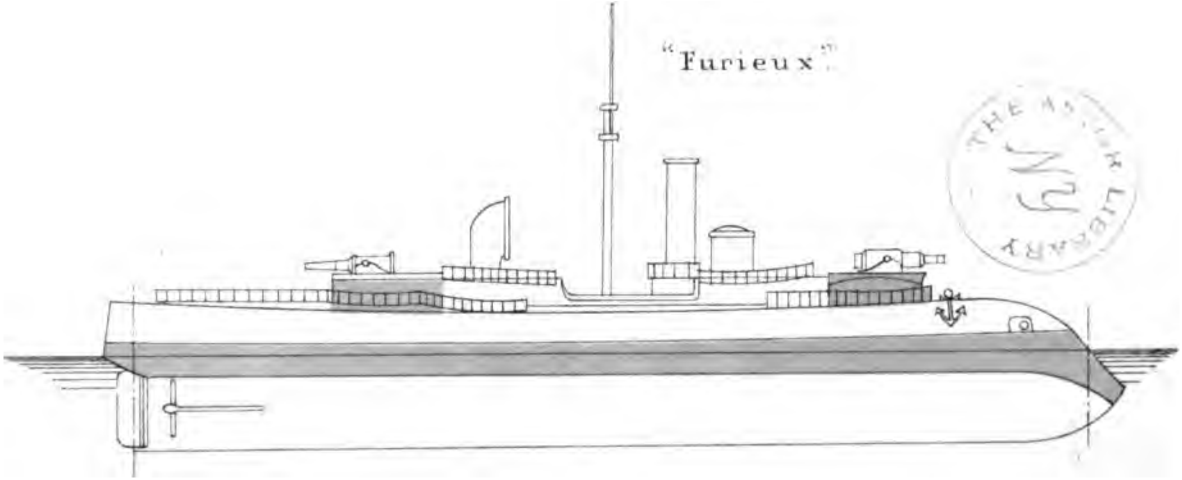
FRENCH SHIPS.

Pl. 72.

"Friedland".



"Furieux".



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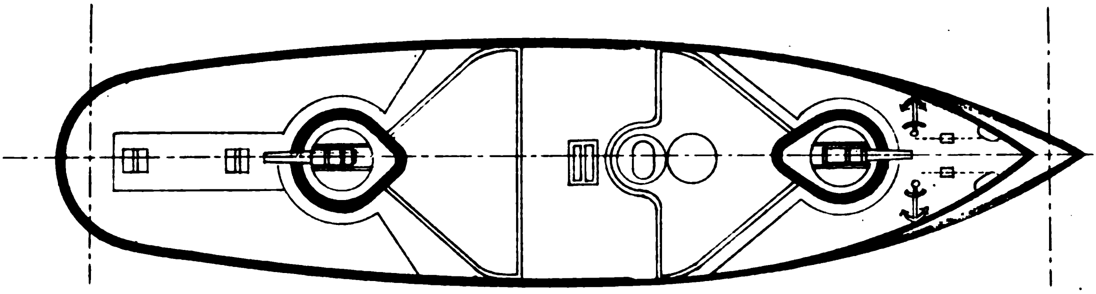
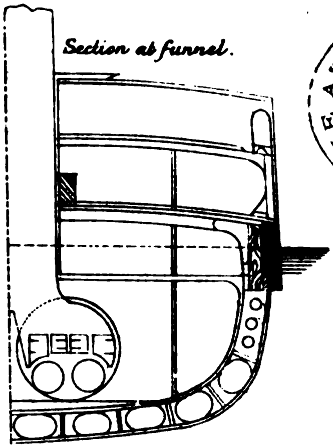
FRENCH SHIPS.

"Furieux".




Section at funnel.

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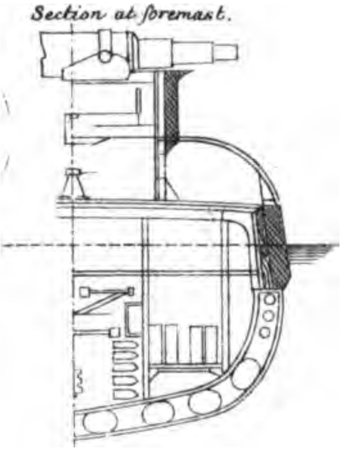
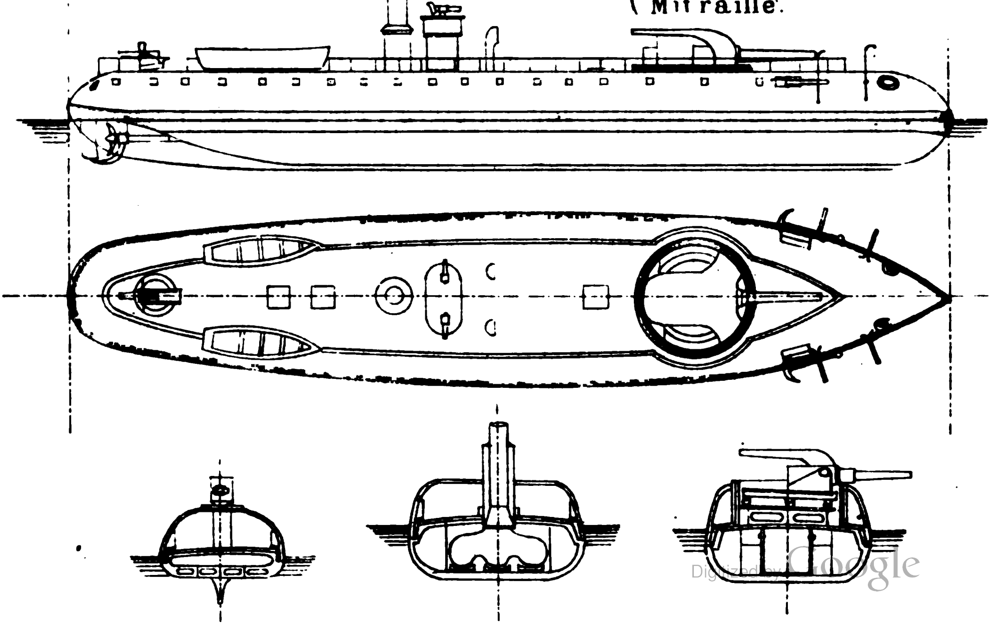

Section at foremast.

"Fusée". Class

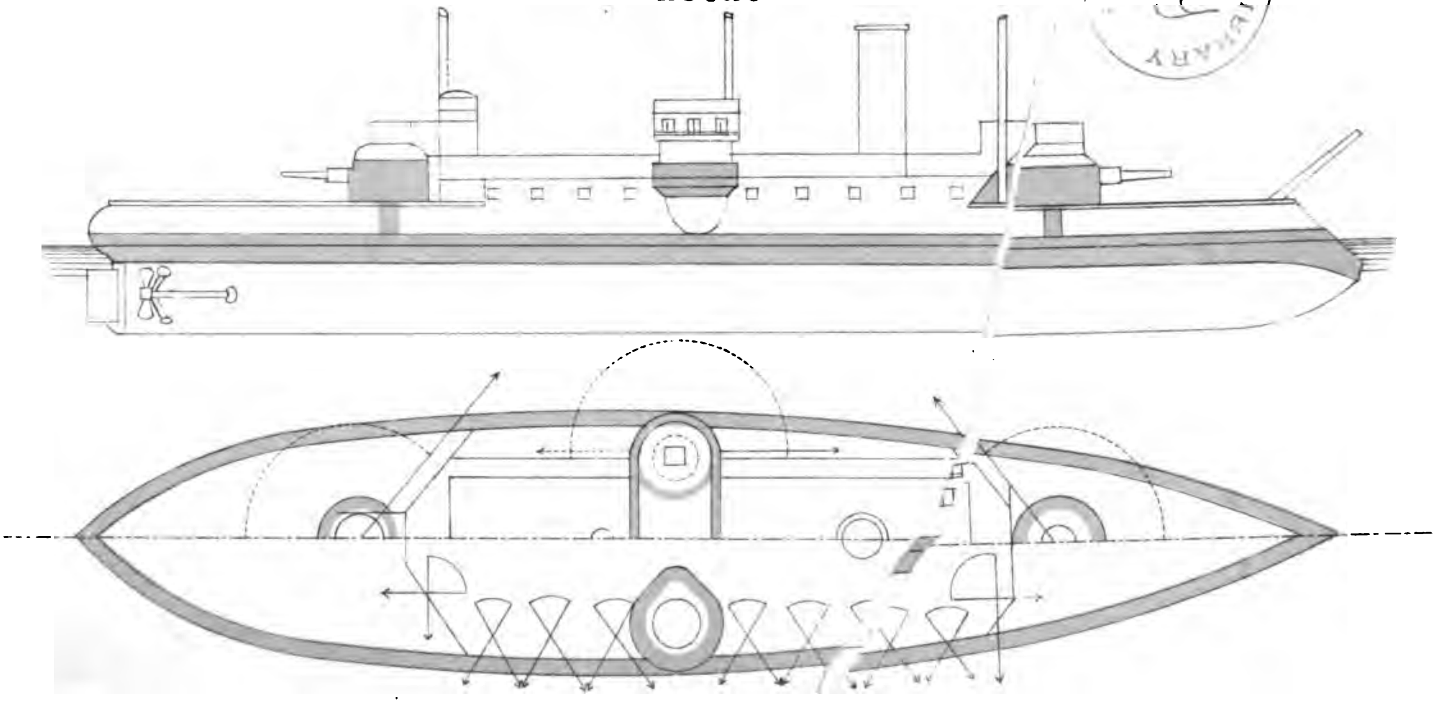
"Flamme".
"Fusée".
"Grenade".
"Mitraille".



Pl. 74.

FRENCH SHIPS.

"Hoche"



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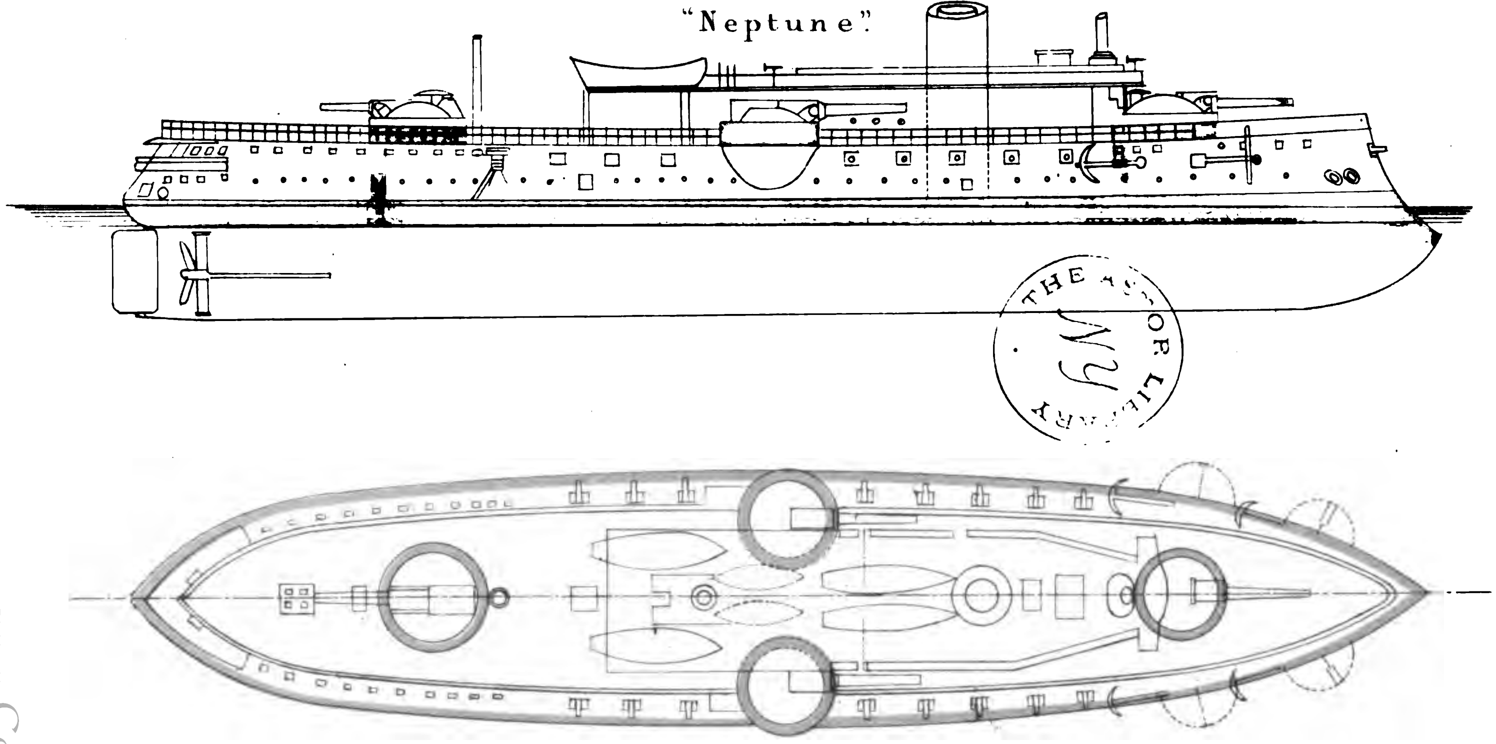
FRENCH SHIPS.

Pl. 75.

"Magenta."
"Marceau."
"Neptune."



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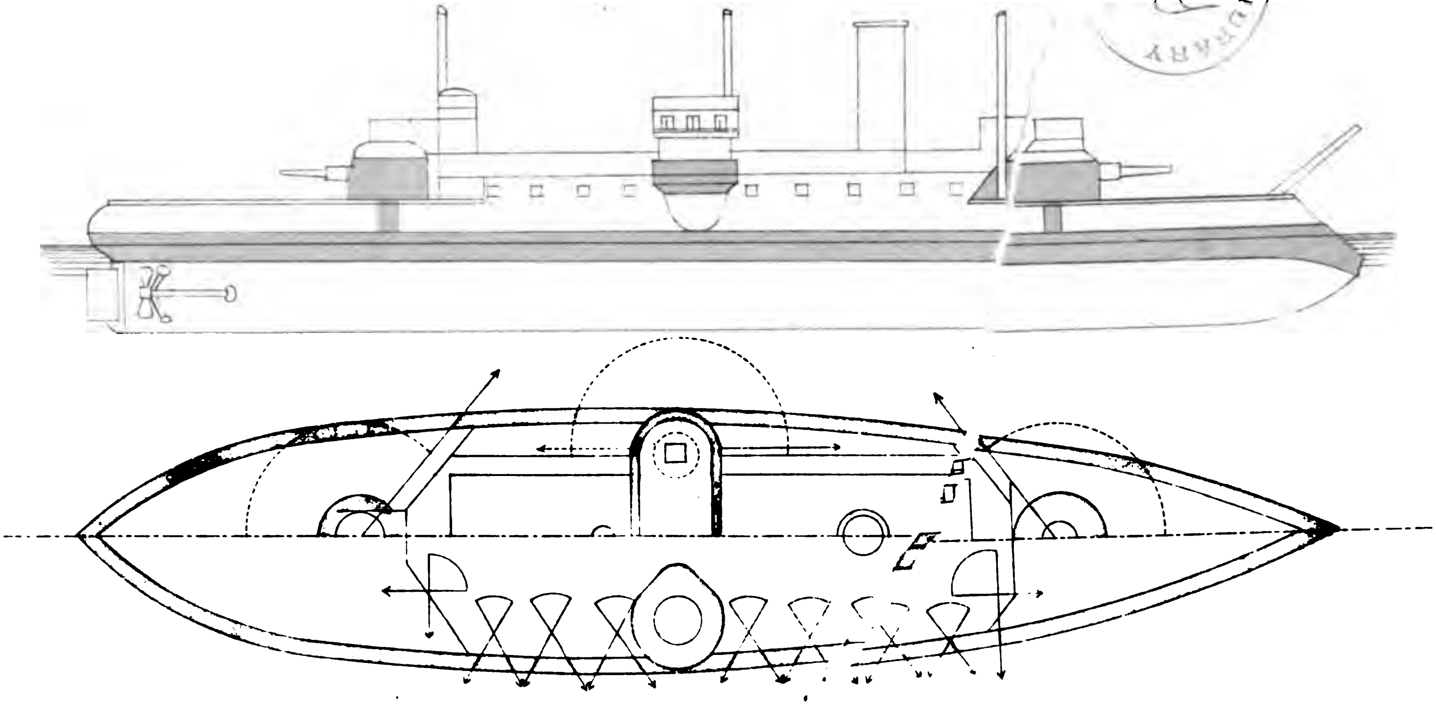
Pl. 74.

FRENCH SHIPS.

"Hoche"



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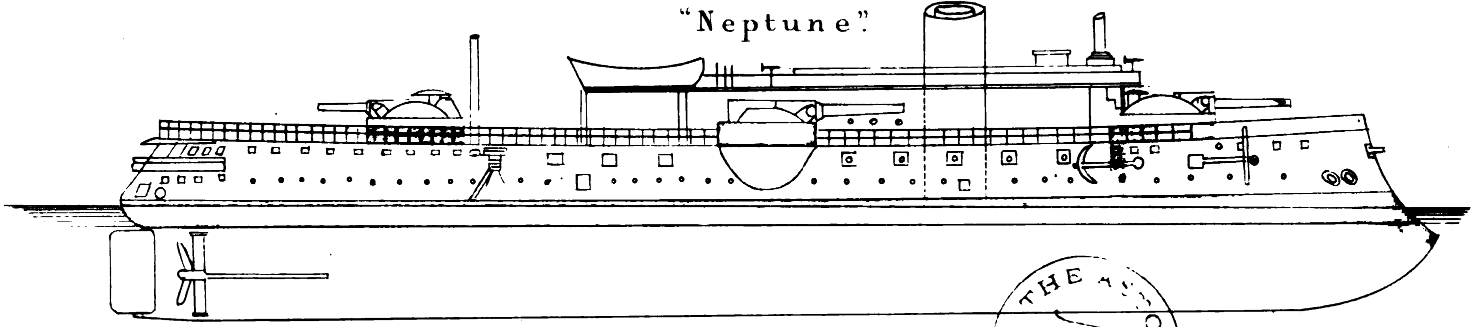
FRENCH SHIPS.

"Magenta."
"Marceau."
"Neptune."



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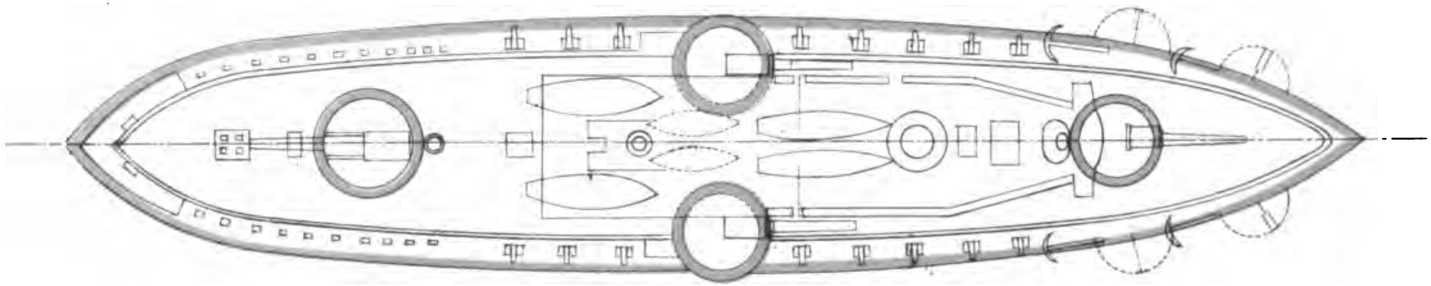
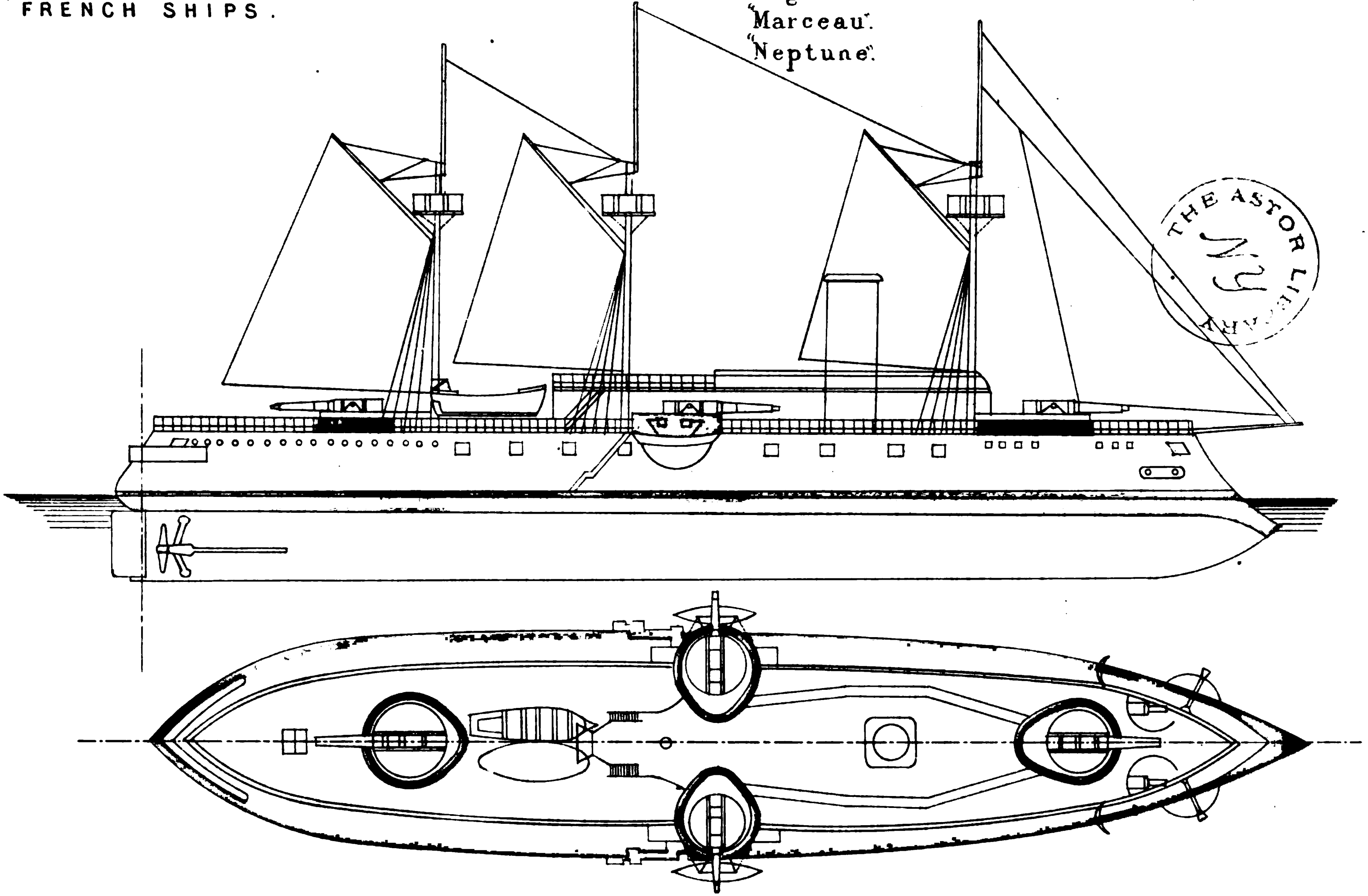


FRENCH SHIPS.

Pl. 76.

Magenta.
"Marceau".
"Neptune".



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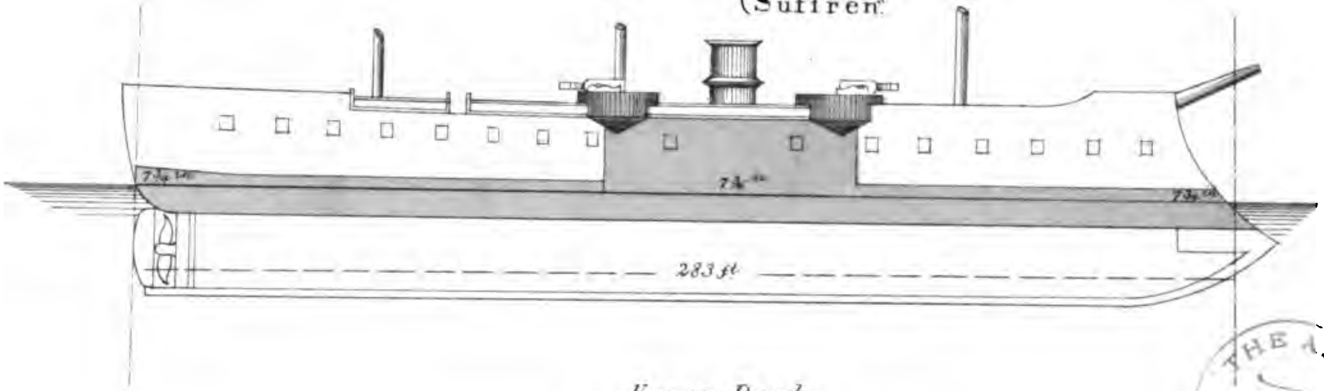
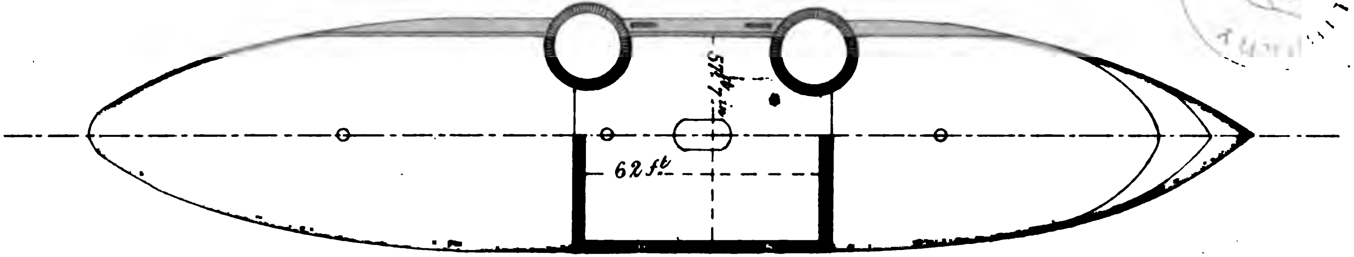
HANHART LITH.

FRENCH SHIPS.

Ocean *Class* { "Marengo".
"Ocean".
"Suffren".



Upper Deck



Main Deck

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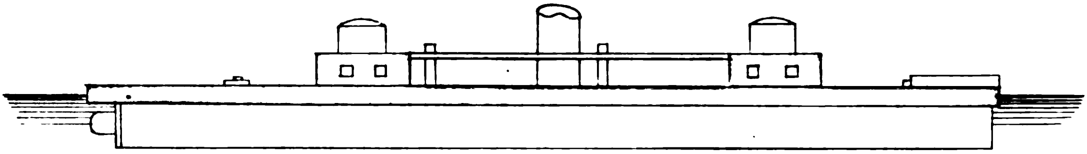
HANHART LITH

Pl. 78.

FRENCH SHIPS.

"Onondaga"



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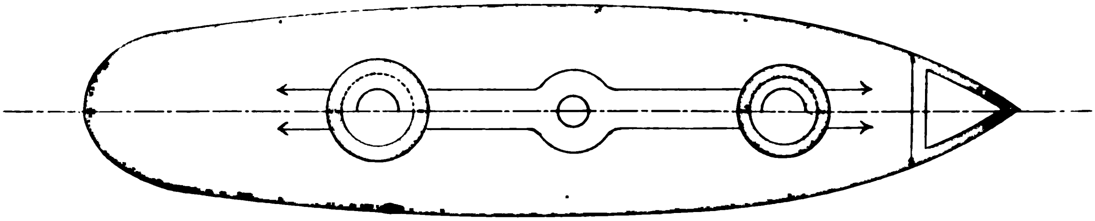

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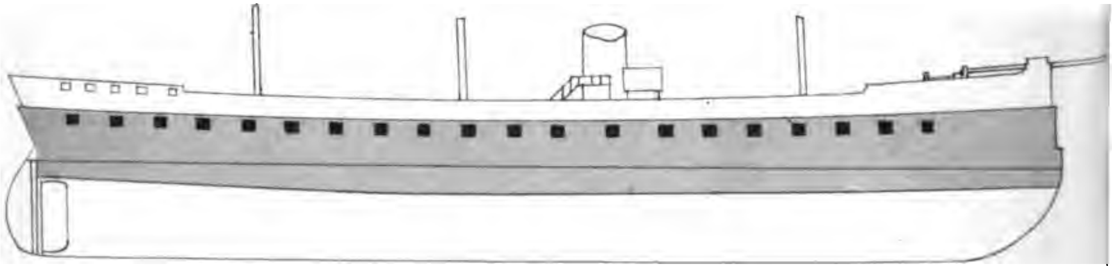
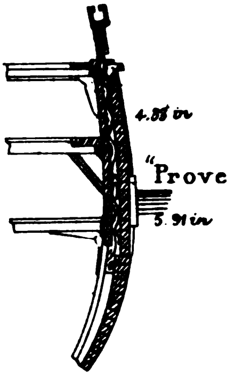
"Provence".
"Heroine".
"Revanche".
"Surveillante".
"Valeureuse".



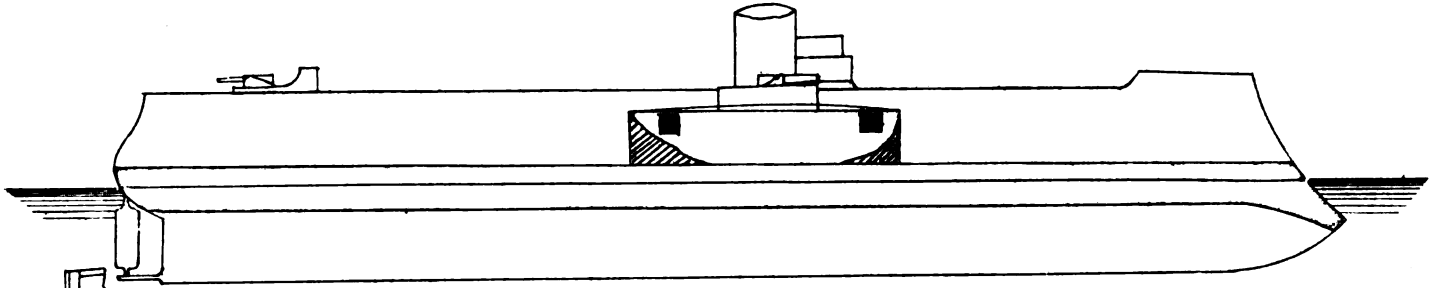


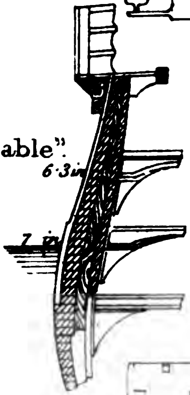
"Provence".

HANHART LITH

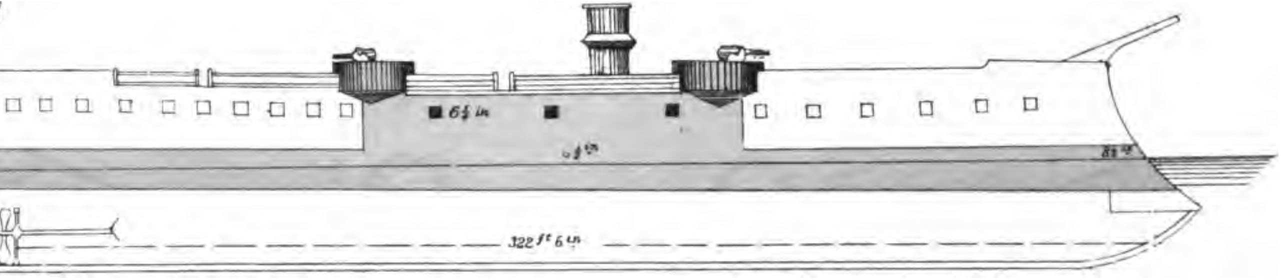
FRENCH SHIPS.

"Redoutable".




"Redoutable".

"Richelieu".



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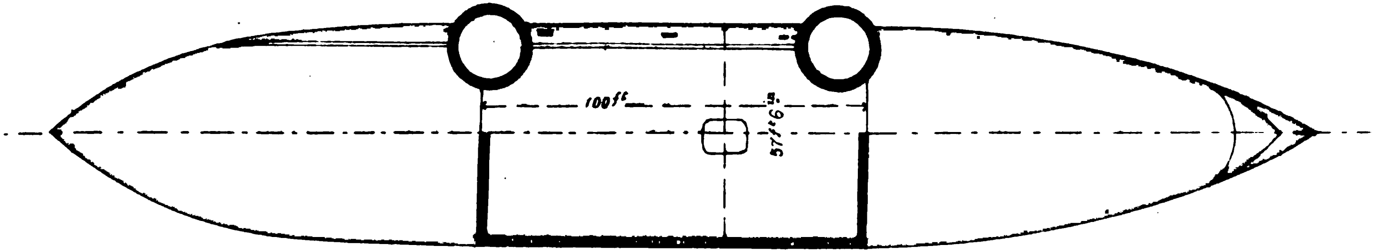
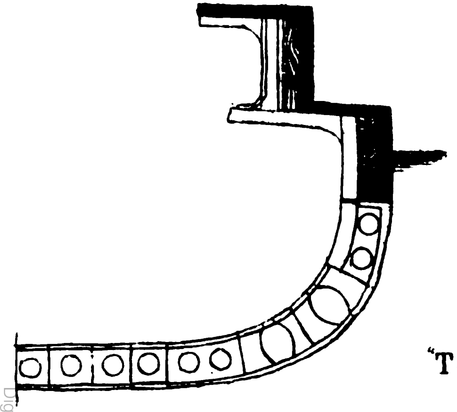
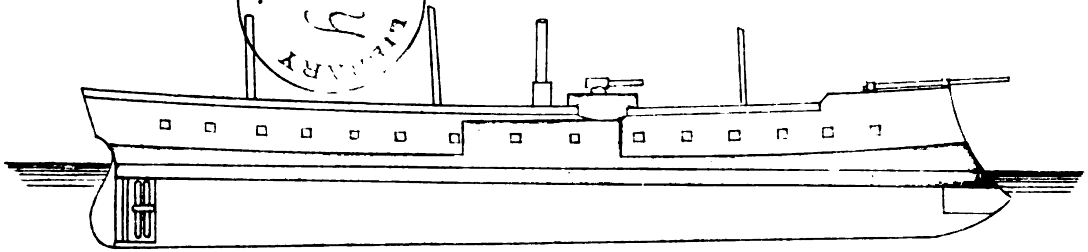
FRENCH SHIPS.



"Riehelieu".



"Thétis".



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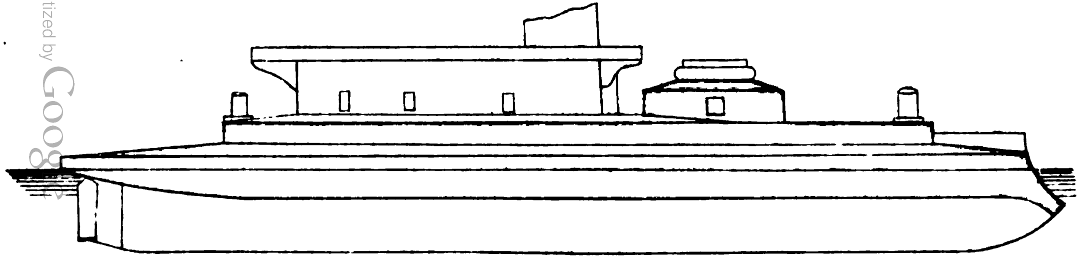
"Tonnerre".

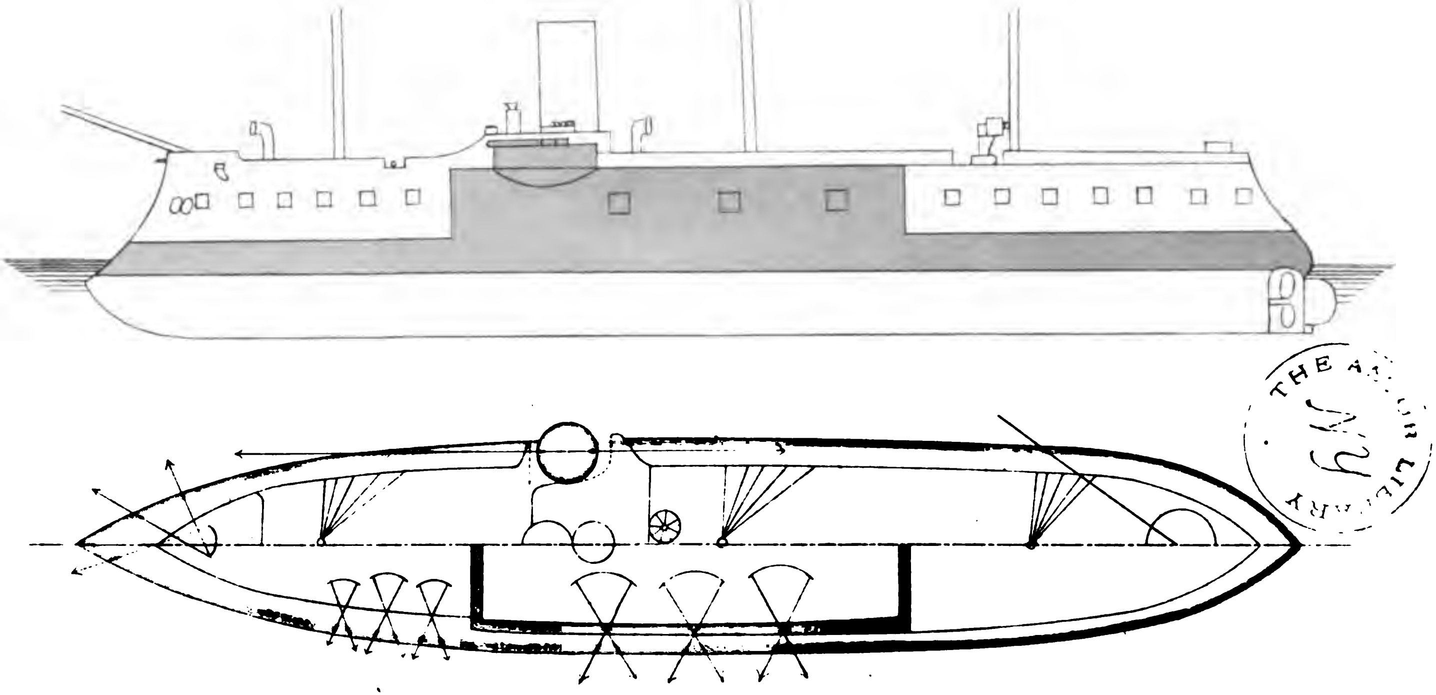


Hanhart Lith

FRENCH SHIPS.

Pl. 81.

"Trident".



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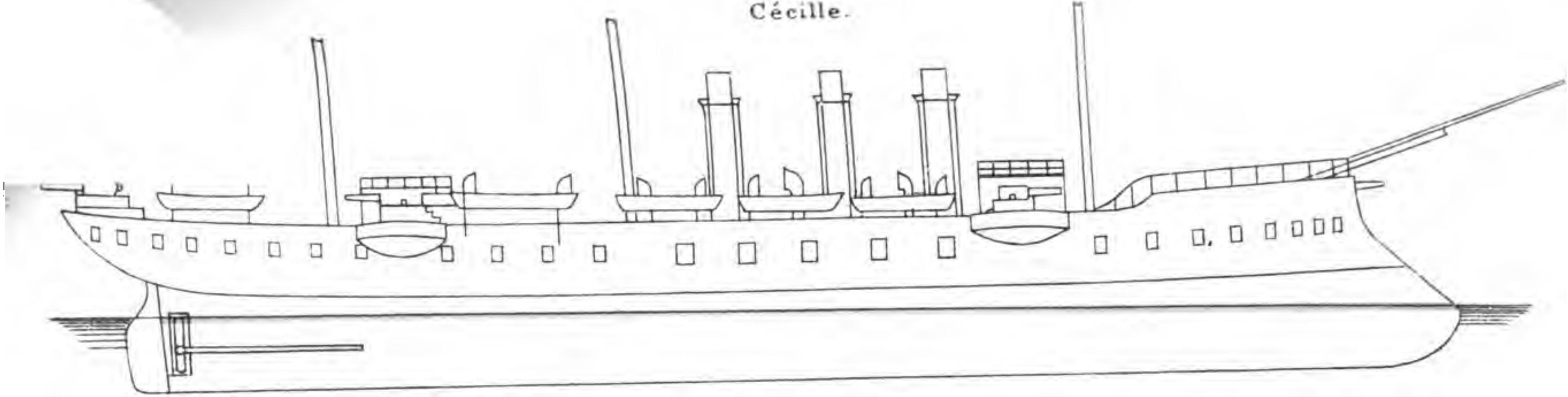
HANHART LITH.

Pl. 82.

FRENCH SHIPS

Cécille.



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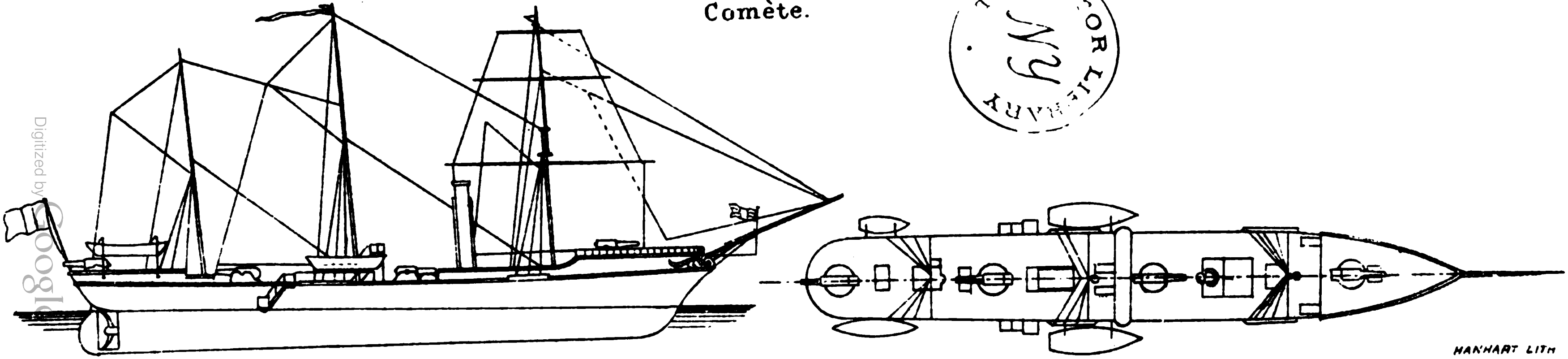

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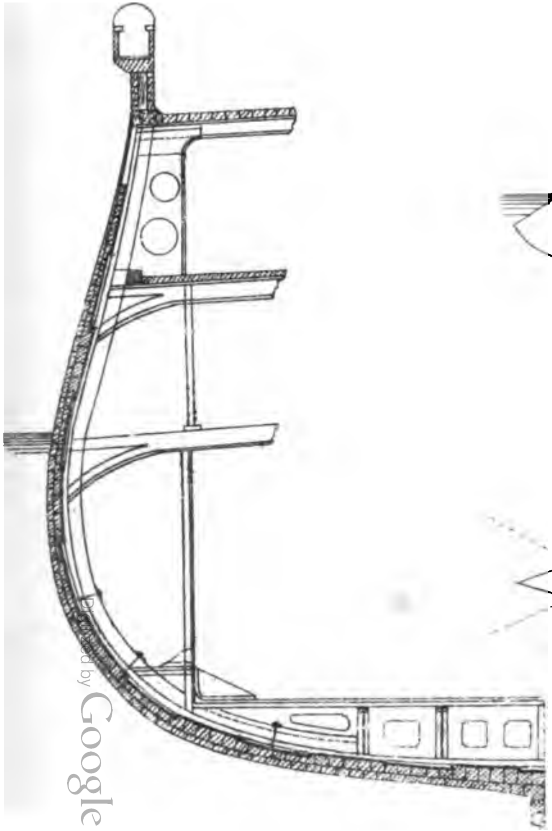
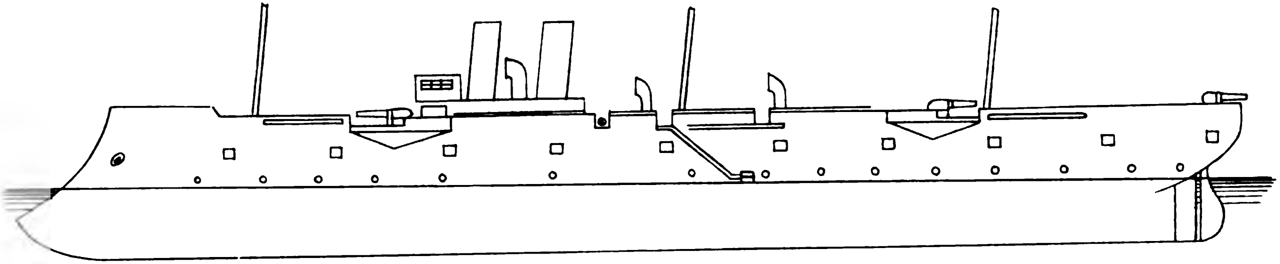
Pl. 83.

FRENCH SHIPS.

Duguay-Trouin.





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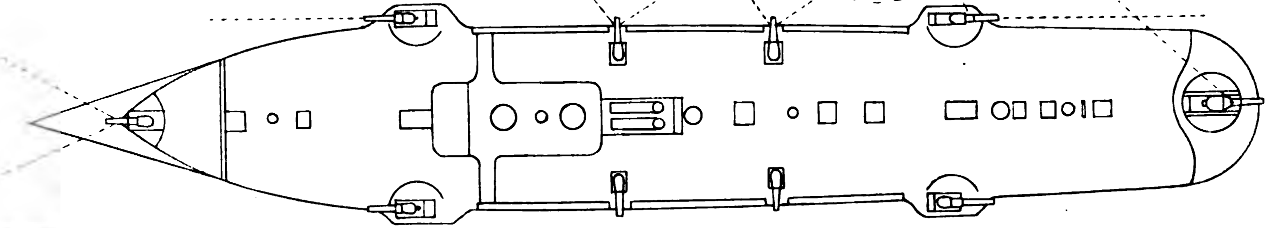
Upper Deck



HANHART, LITH.

FRENCH SHIPS.

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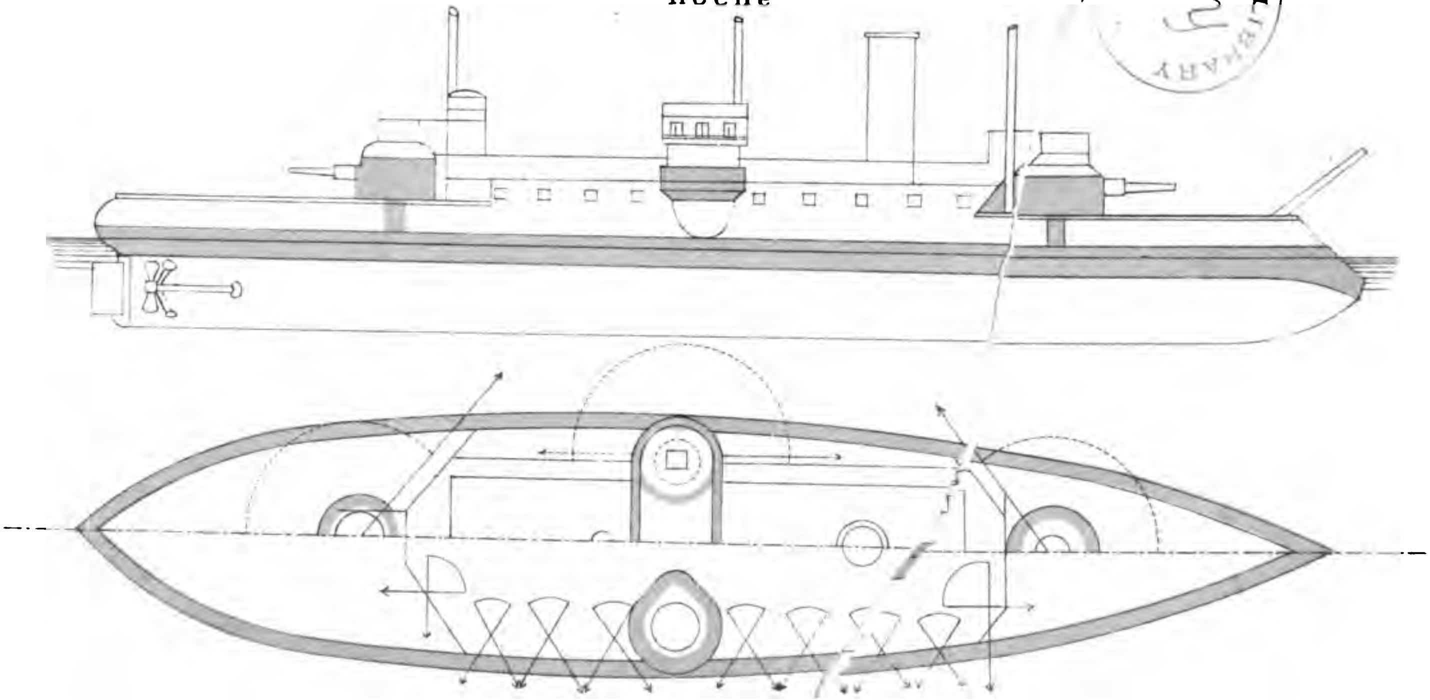
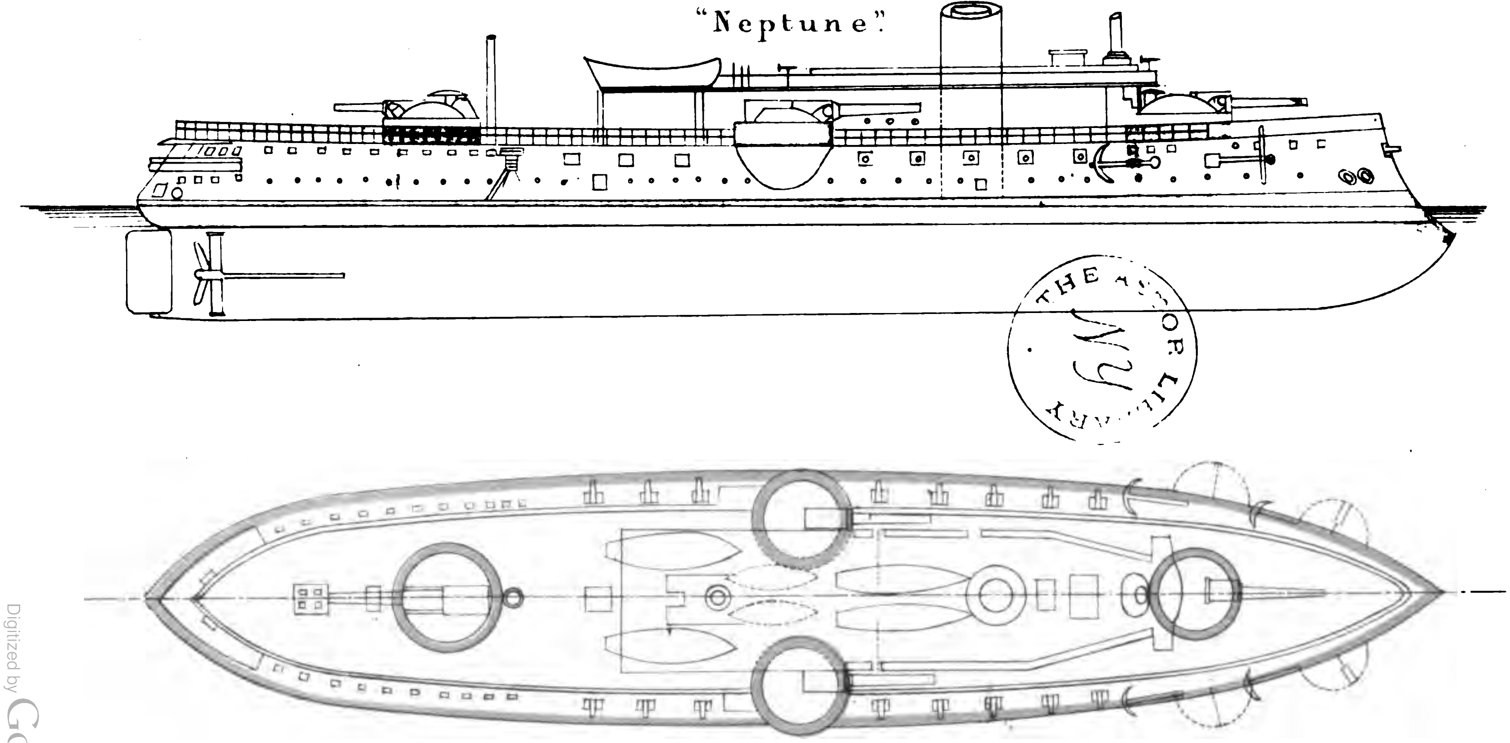


"Hoche"

HANHART

FRENCH SHIPS

"Magenta."
"Marceau."
"Neptune."



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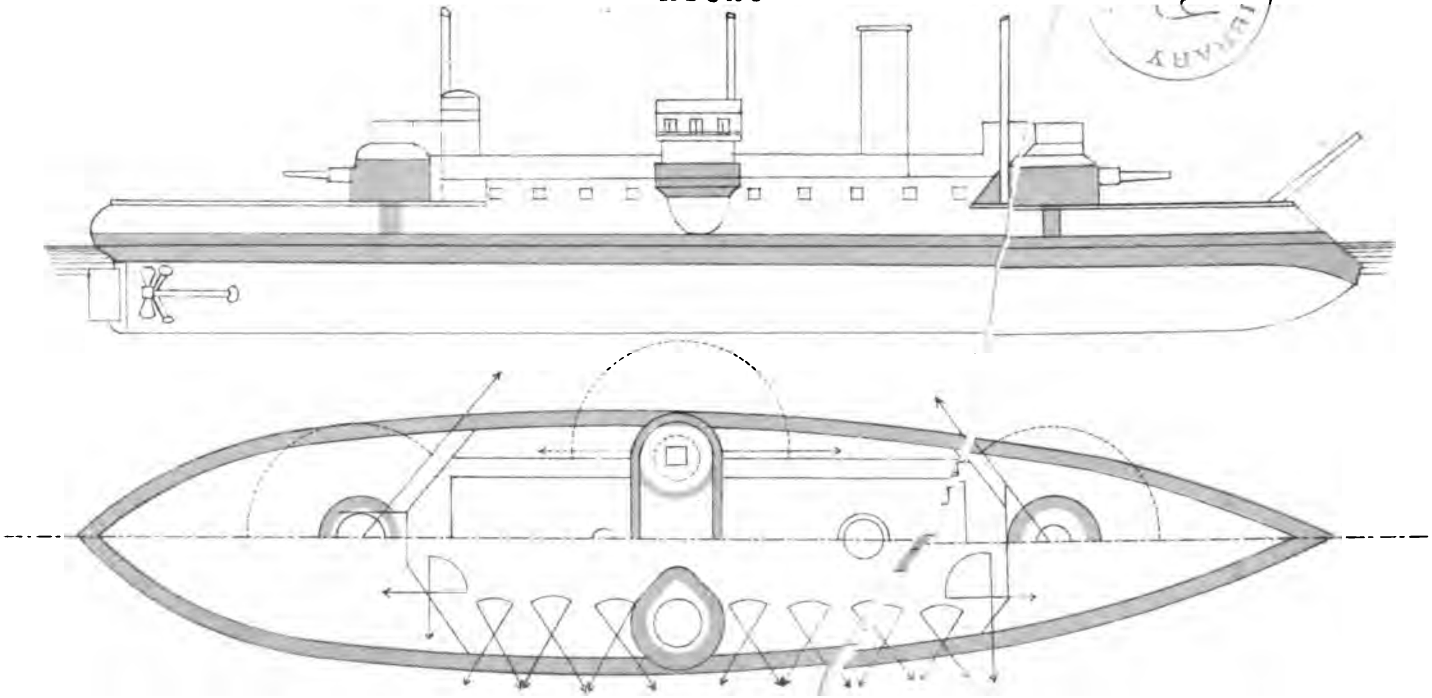
Pl. 74.

FRENCH SHIPS.

"Hoche"



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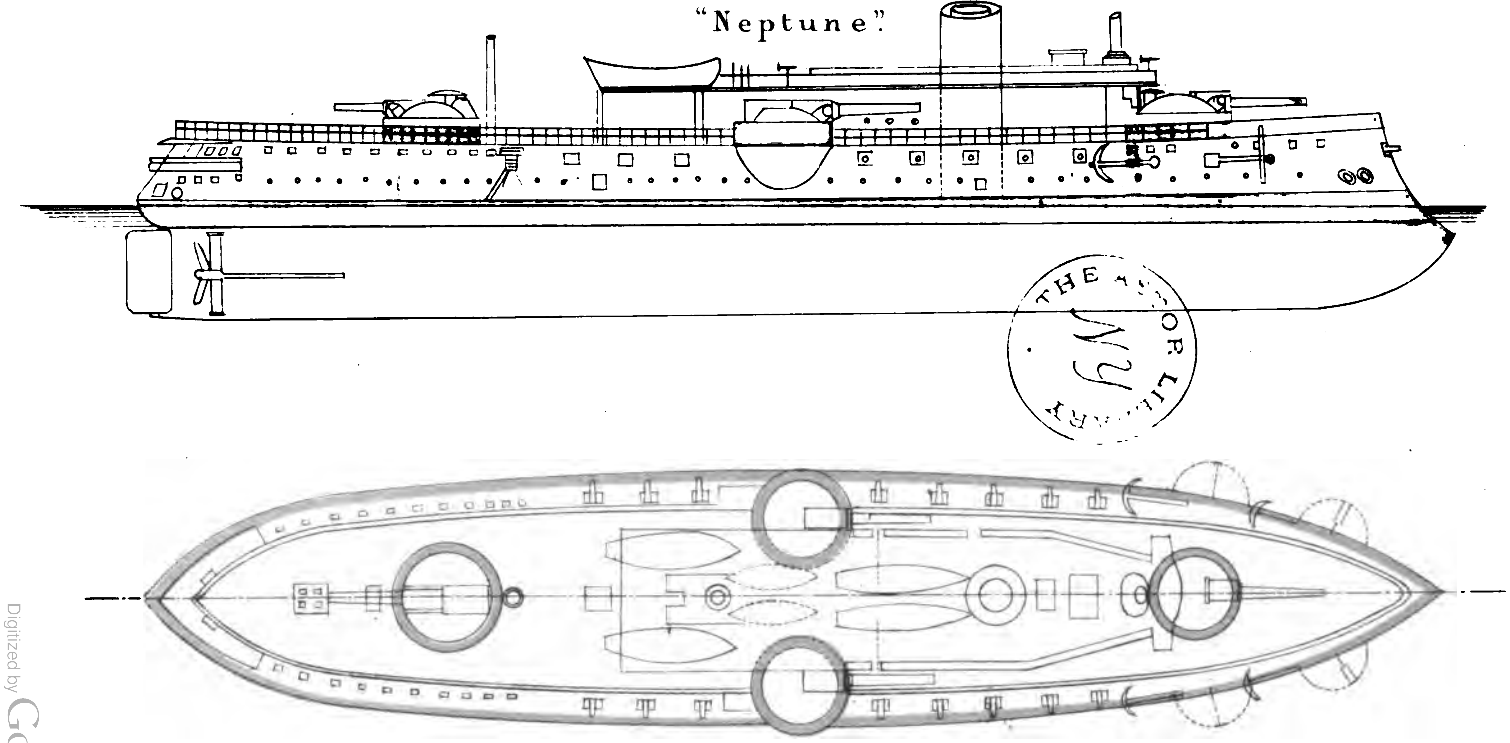
FRENCH SHIPS

Pl. 75.

"Magenta."
"Marceau."
"Neptune."



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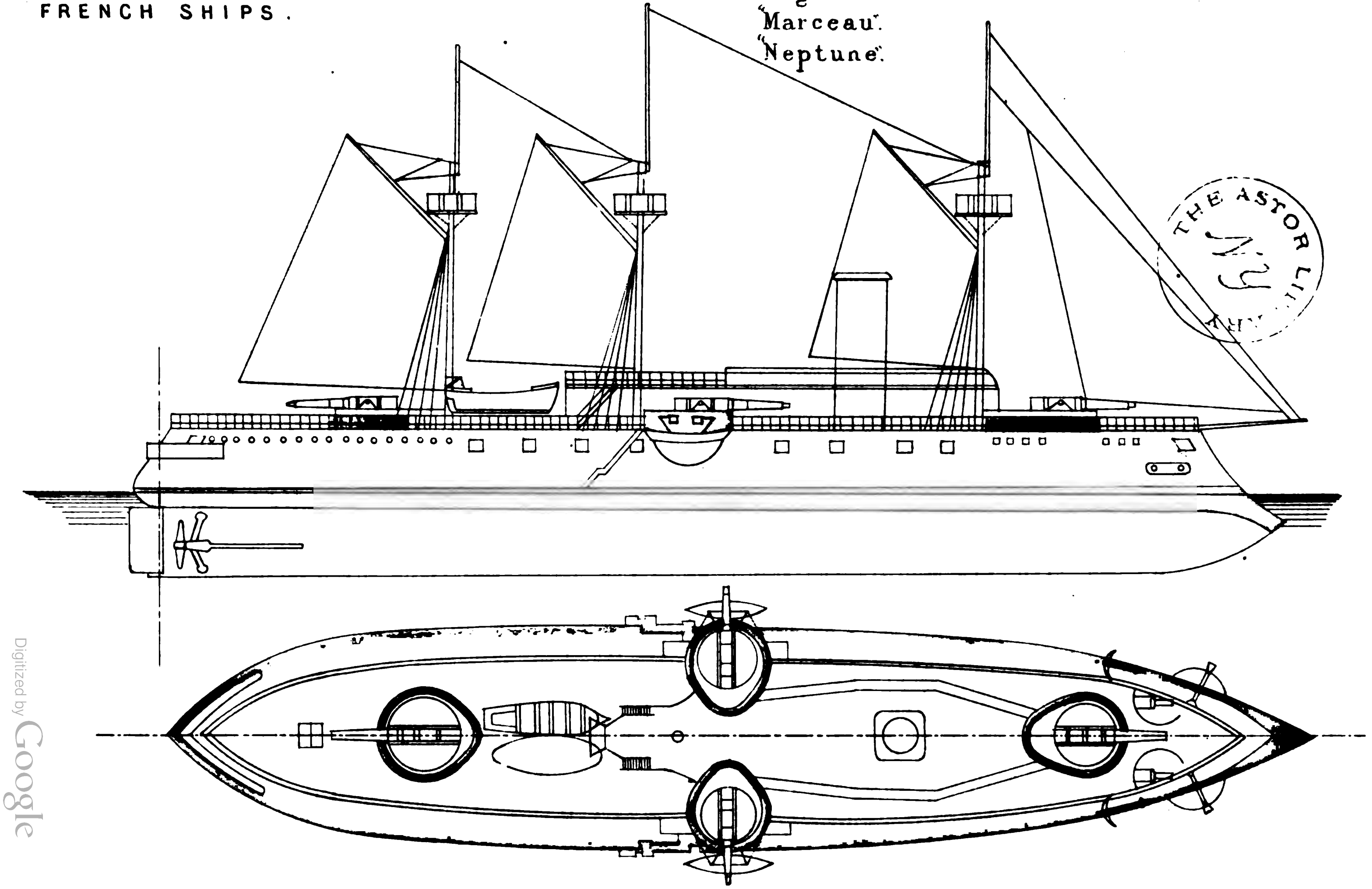
FRENCH SHIPS.

"Magenta."
"Marceau."
"Neptune."



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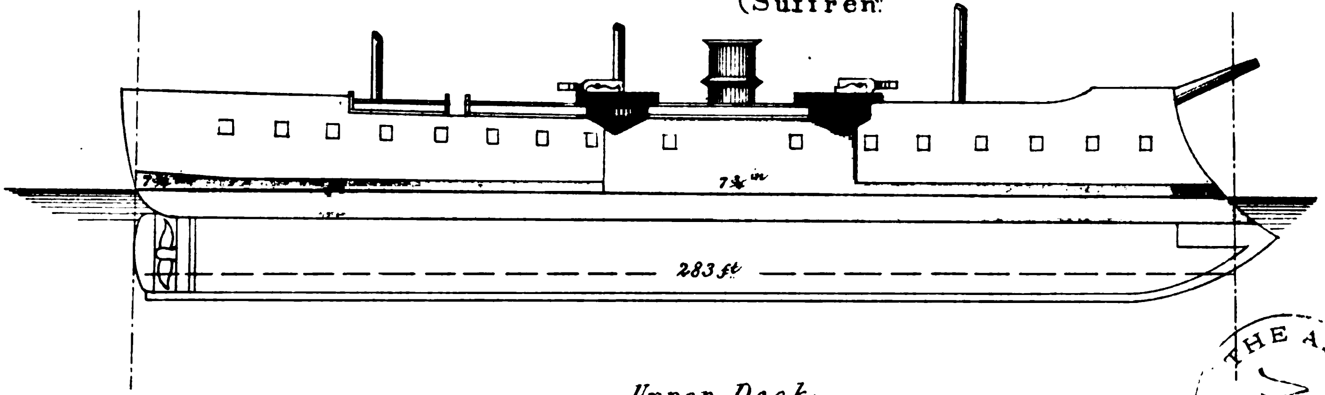
HANHART LITH

FRENCH SHIPS.

Ocean *Class* { "Marengo". "Ocean". "Suffren".



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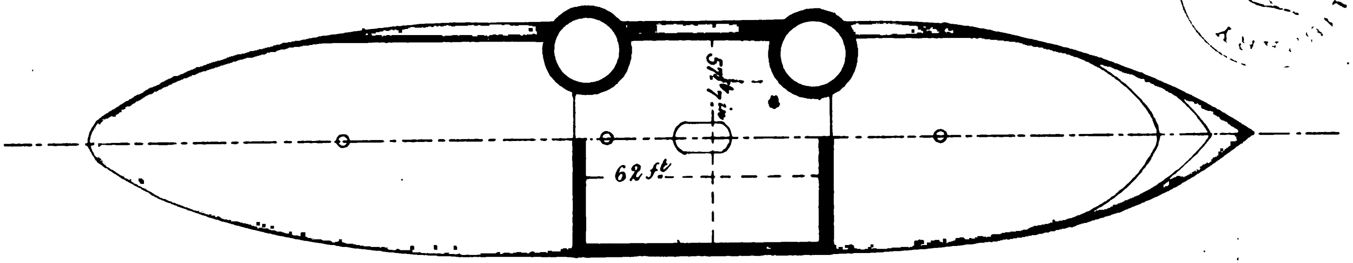

Main Deck

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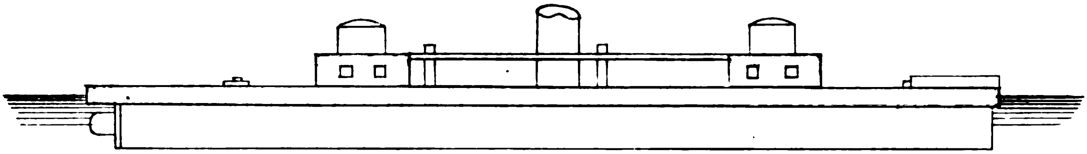
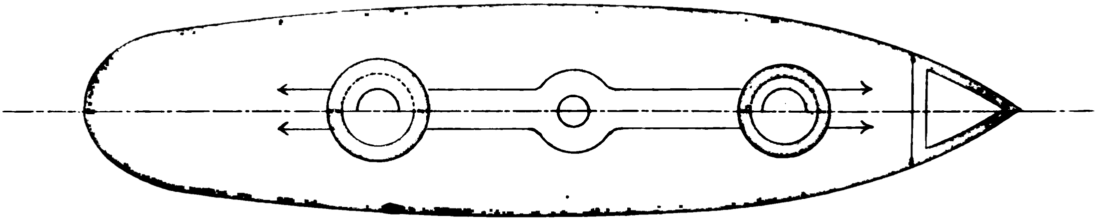
HANHART LITH

FRENCH SHIPS.

"Onondaga"



Upper Deck.



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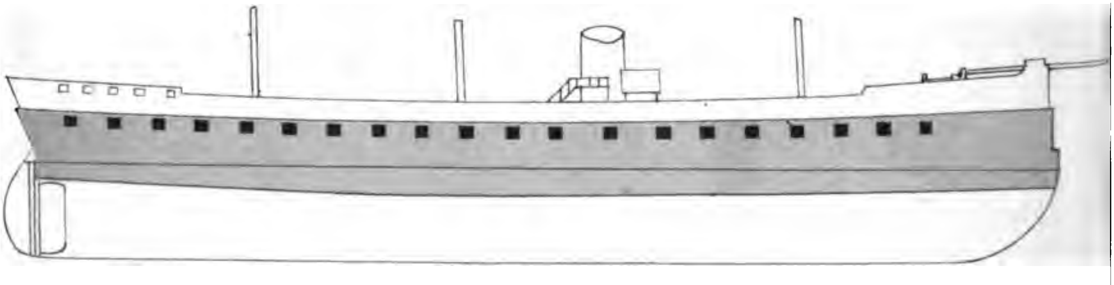
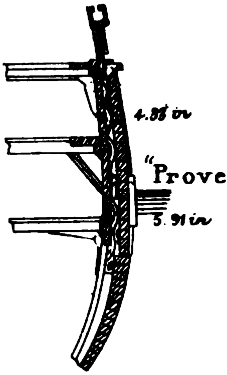
"Provence".
"Heroine".
"Revanche".
"Surveillante".
"Valeureuse".



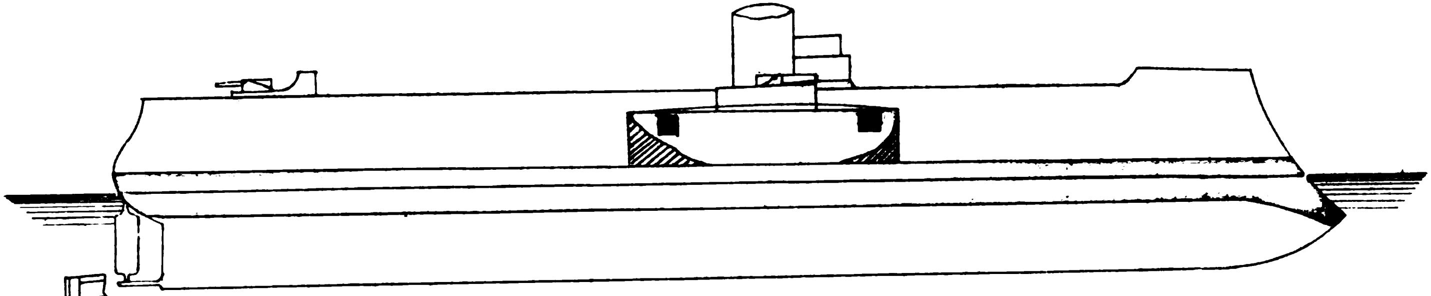


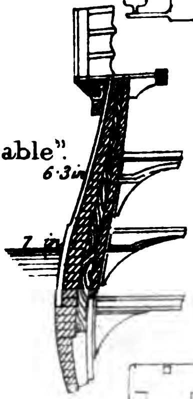
"Provence".

HANHART LITH.

FRENCH SHIPS.

"Redoutable".





"Redoutable".

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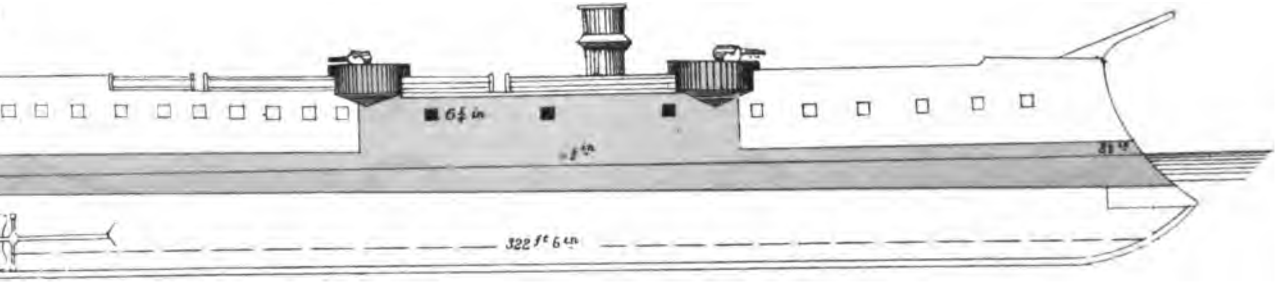
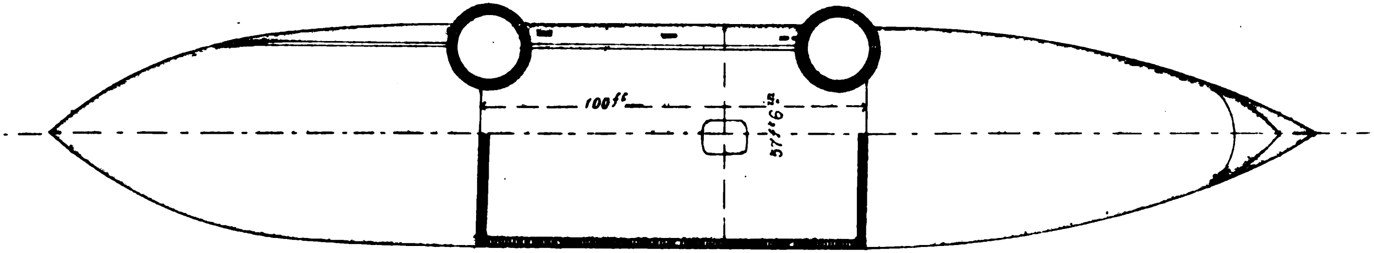
"Richelieu."



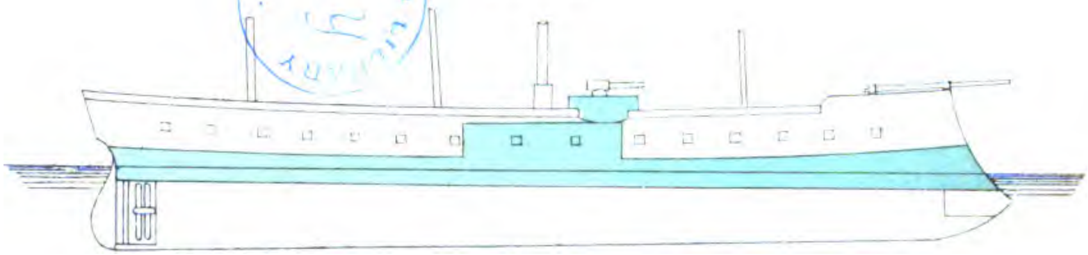
FRENCH SHIPS.

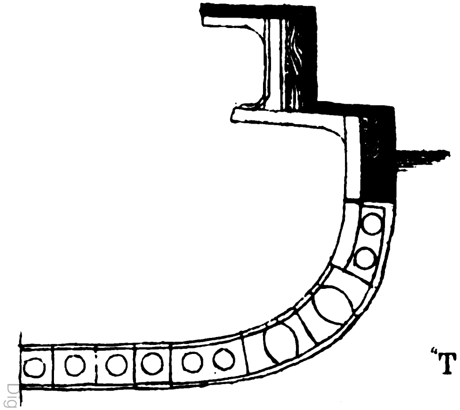
Pl. 80.



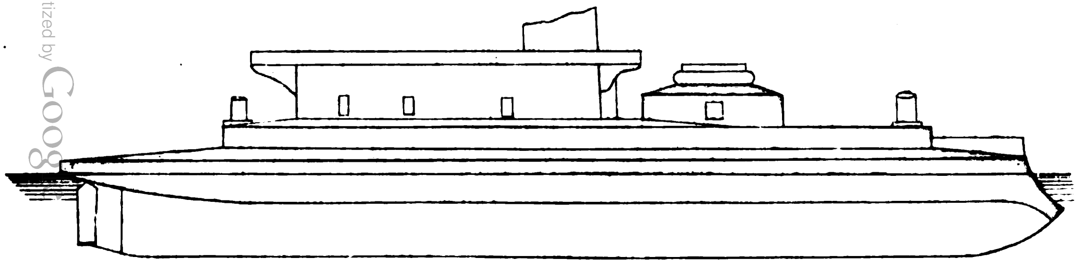
"Richelieu".

"Thétis".





"Tonnerre".

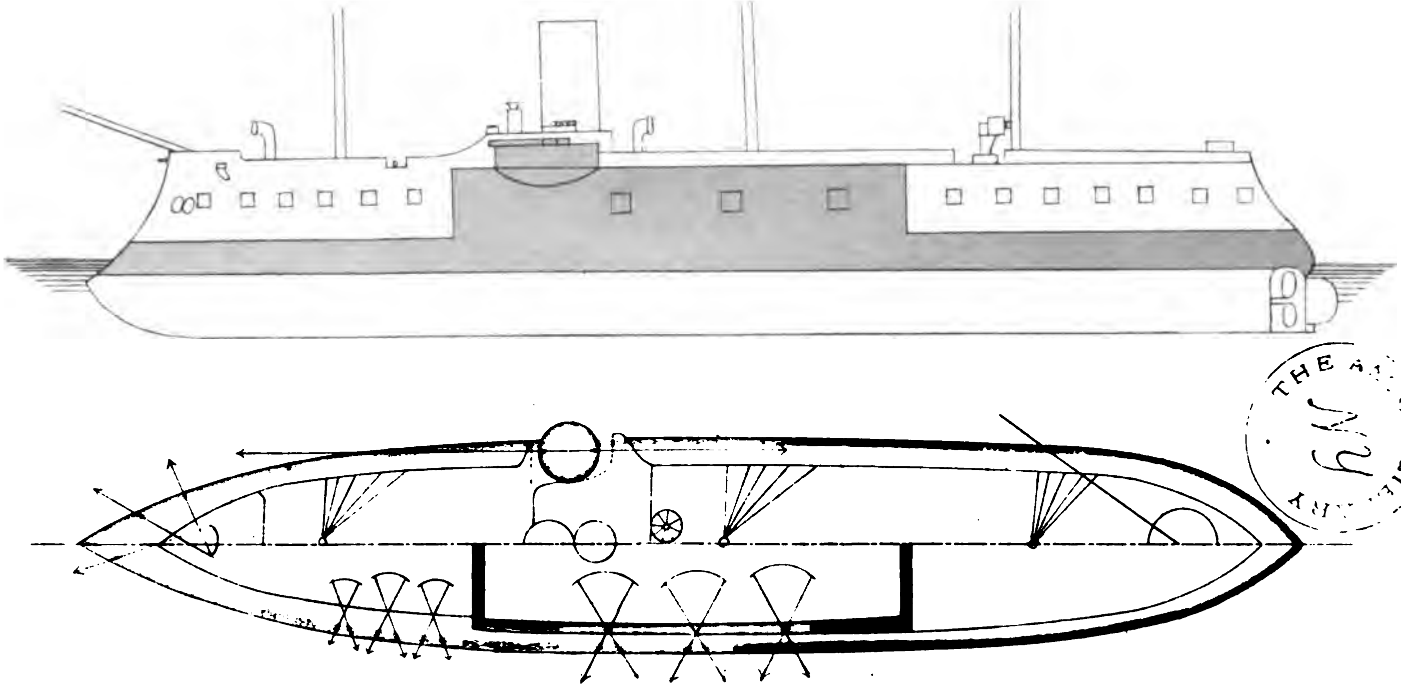


HANHART LITH

Pl. 81.

FRENCH SHIPS.

"Trident".



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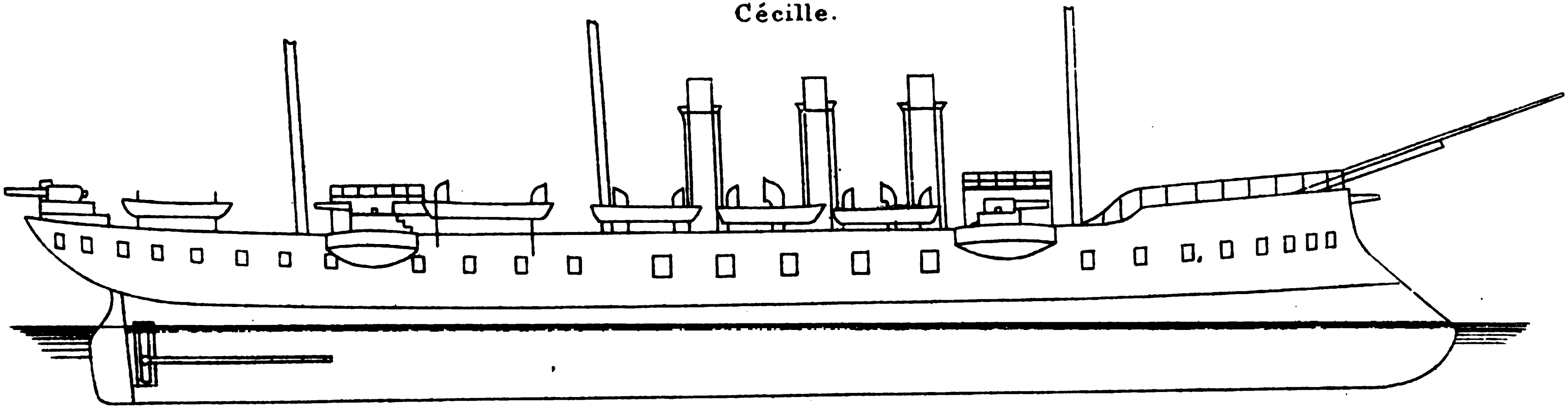
HANHART LITH.

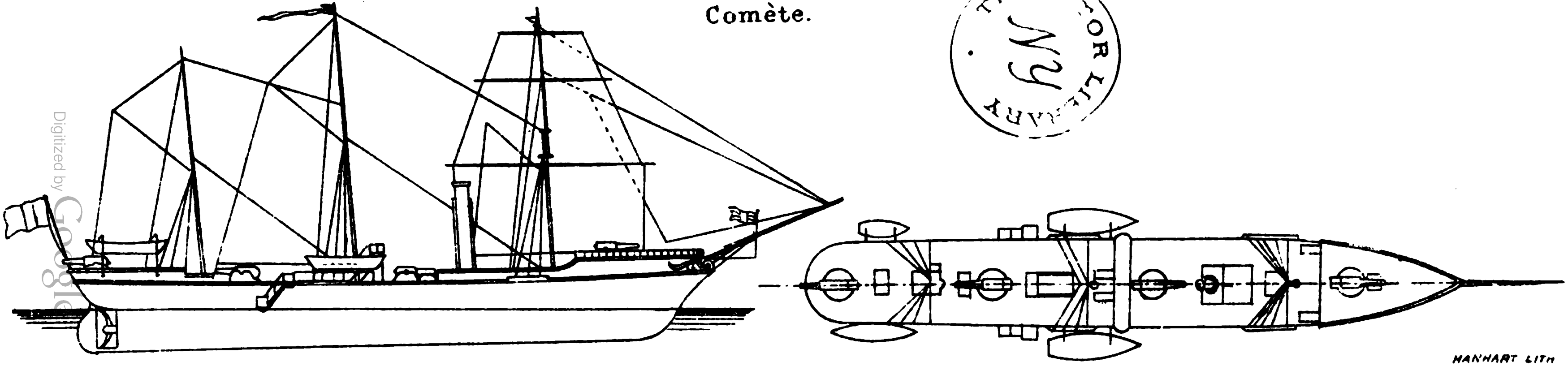
Pl. 82.

FRENCH SHIPS.

Cécille.



Comète.



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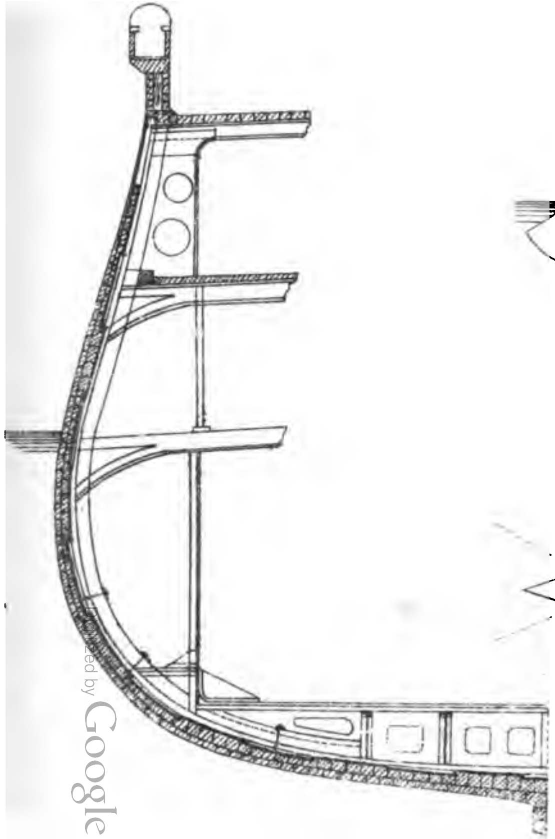
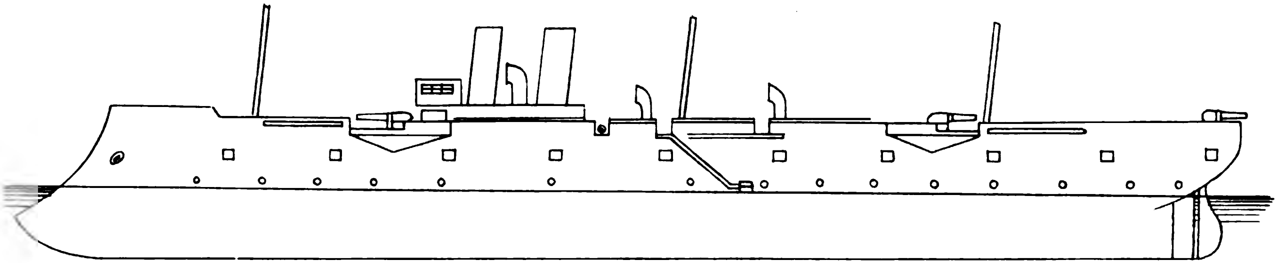
HANHART LITH

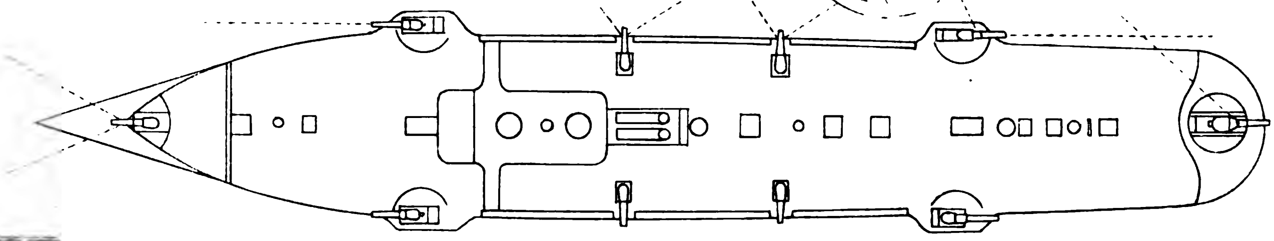
FRENCH SHIPS.



Duguay-Trouin.



Upper Deck



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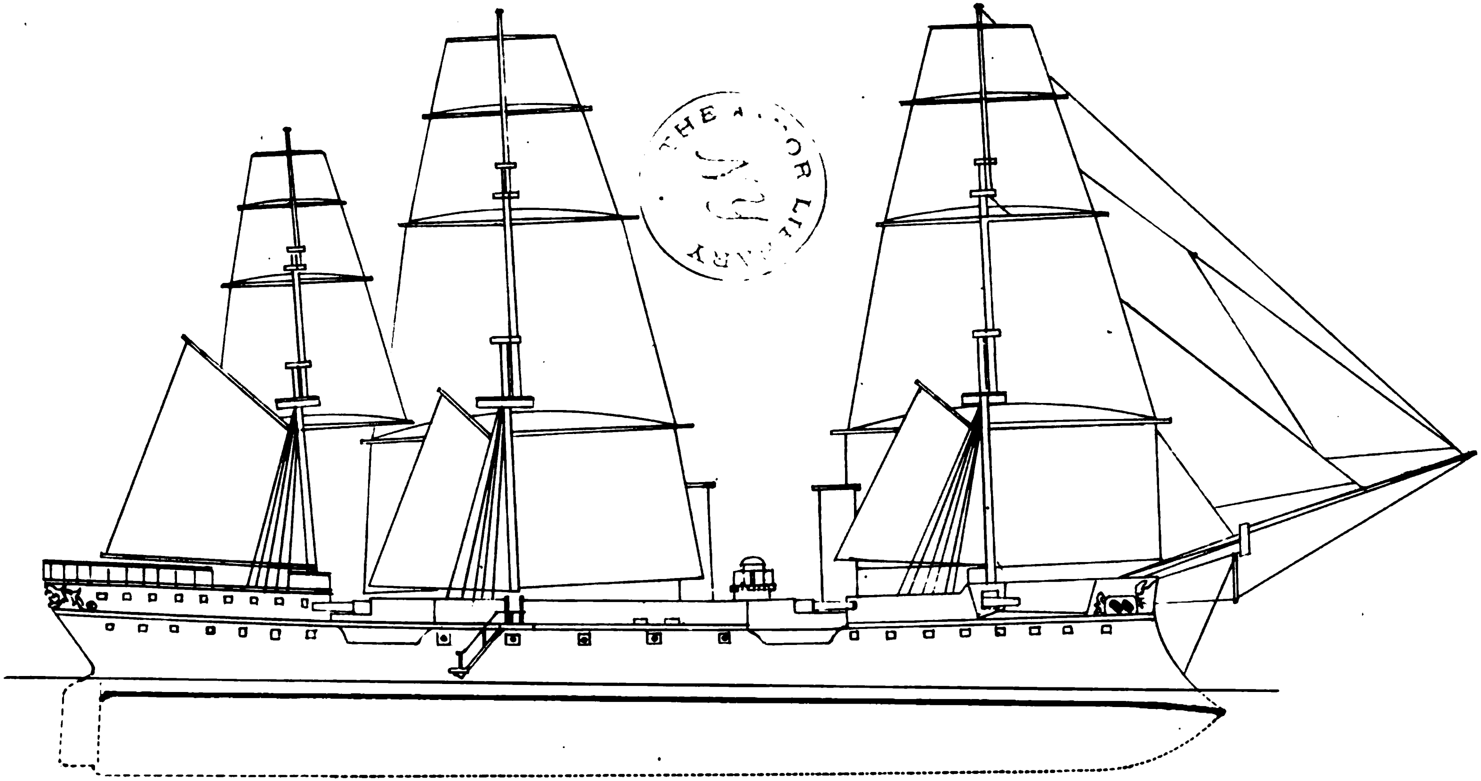
HANHART, LITH.

FRENCH SHIPS

"Sfax". (Cruiser)

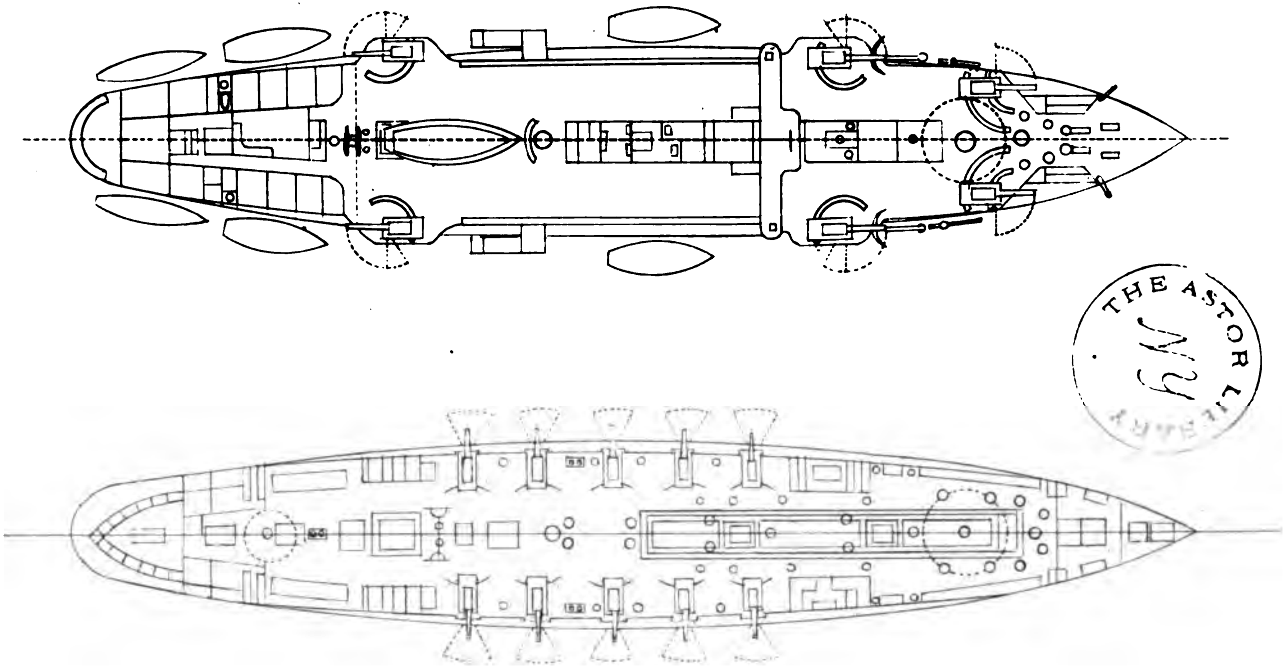


HANHART LITH

Pl. 85.

FRENCH SHIPS.

"Sfax." (Cruiser)



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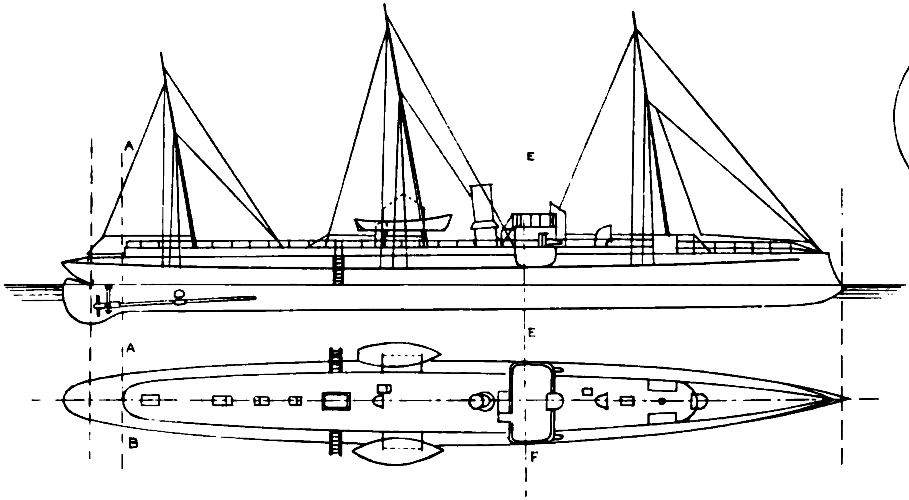
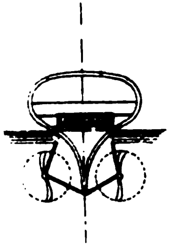
HANHART LITH

Pl. 86.

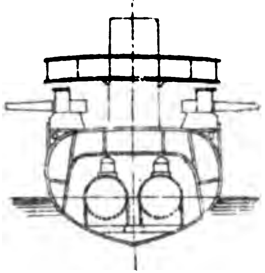
FRENCH SHIPS. **Bombe.**

THE ASTOR L Y

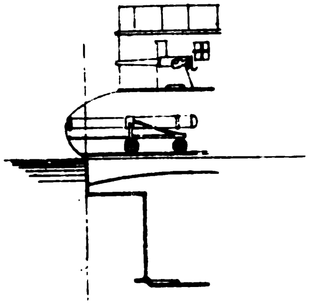




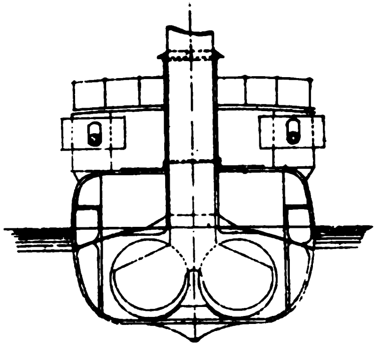
Section on A B



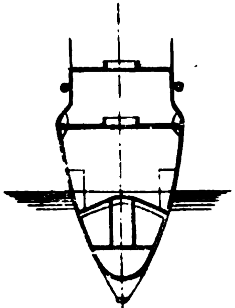
Section on E F.



Aft.



"Condor".
Before the Engine Room.



Forward.

HANHART, LITH

Pl. 87.

FRENCH SHIPS.

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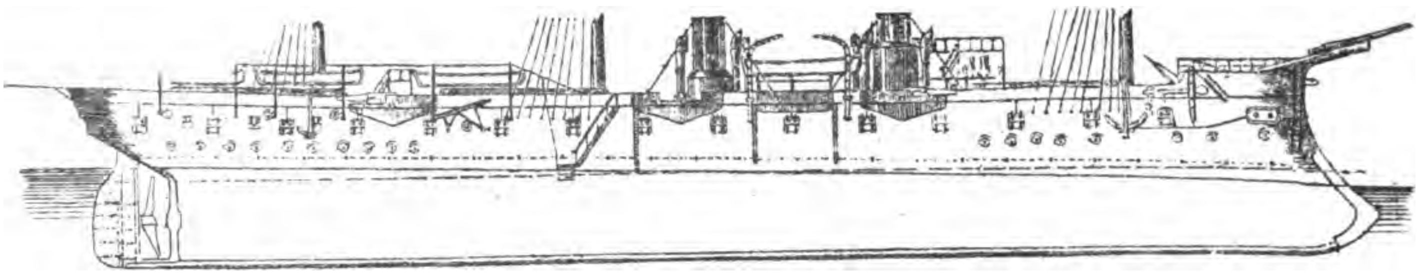
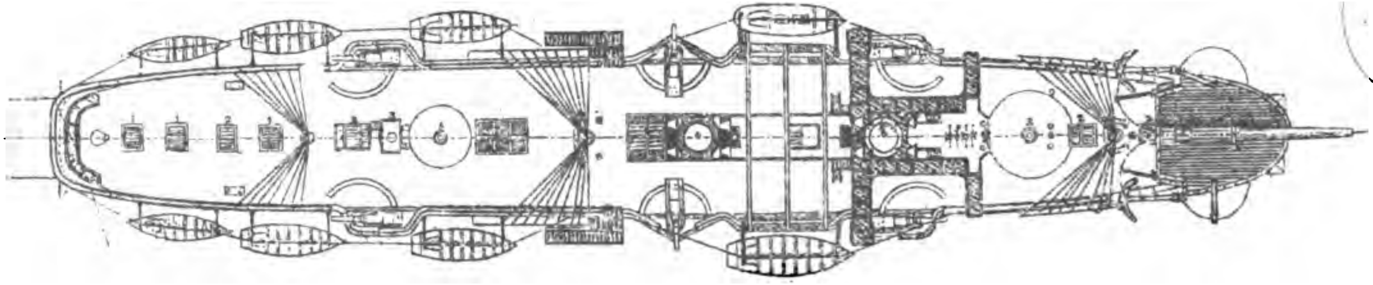
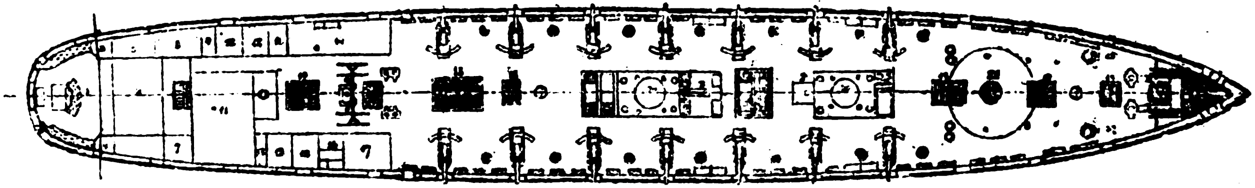


'DUQUESNE.



'DUQUESNE' (UPPER DECK).

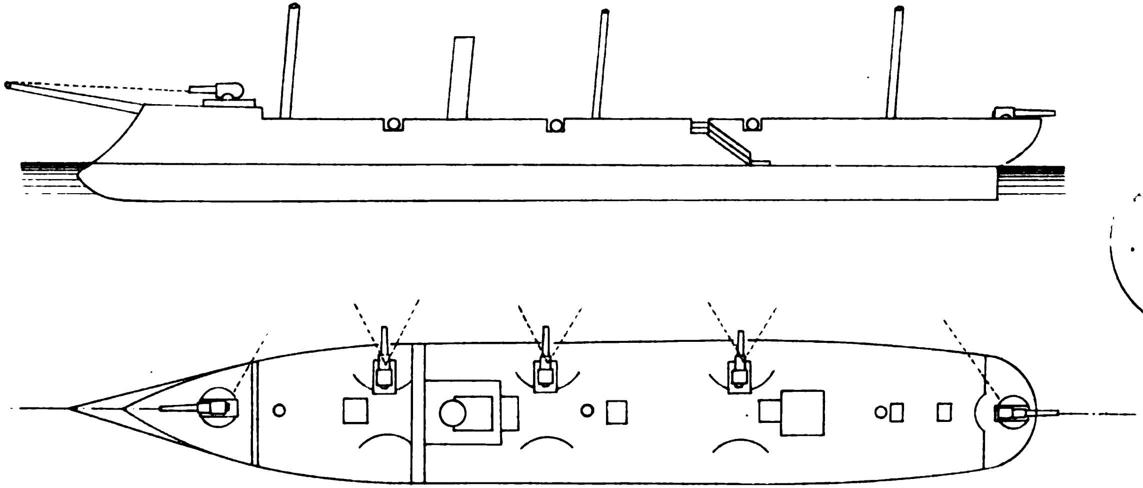


'DUQUESNE' (MAIN DECK).

Pl. 88.

FRENCH SHIPS.

"Eclaireur."



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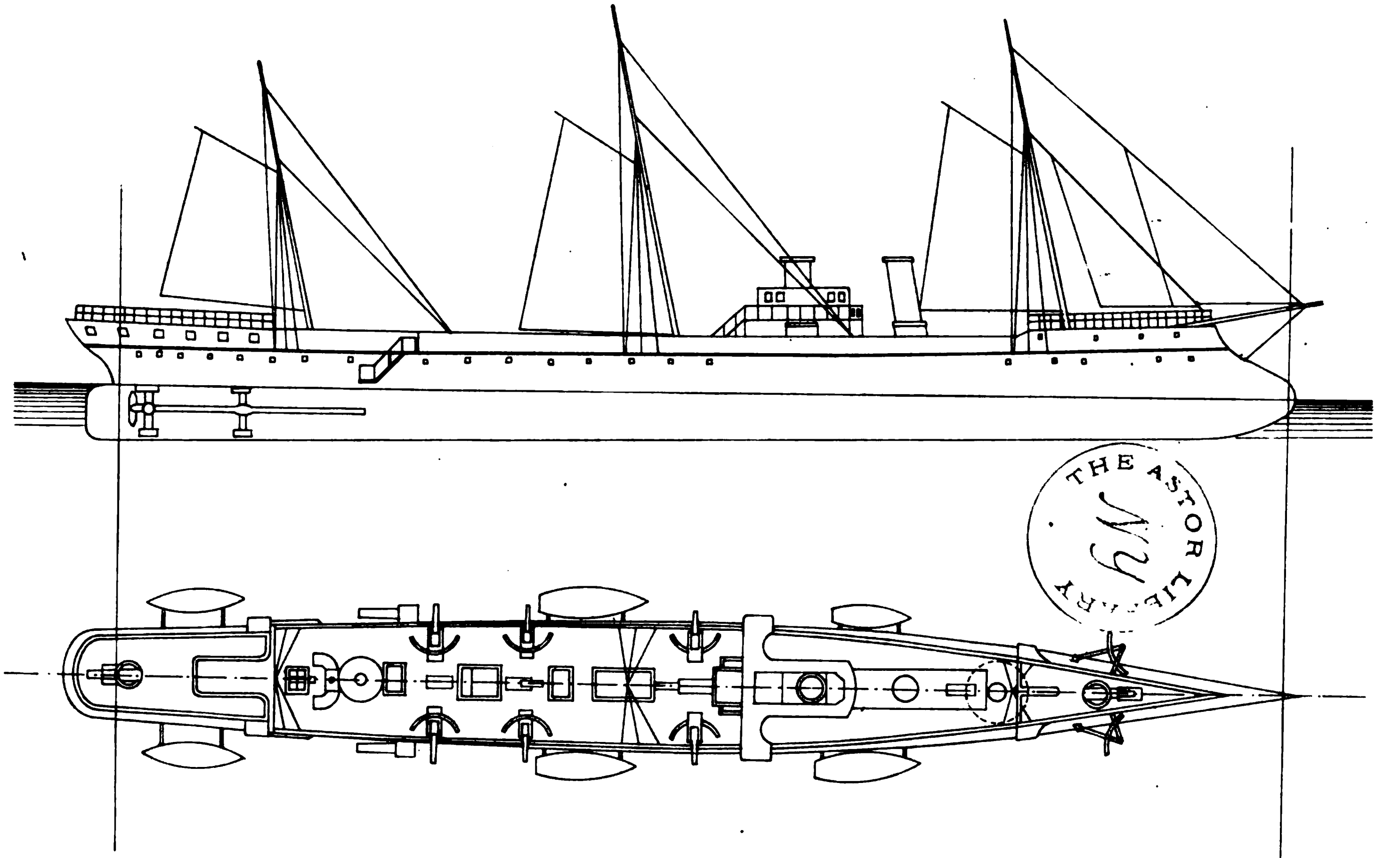
HANNART, LITH

"Milan."



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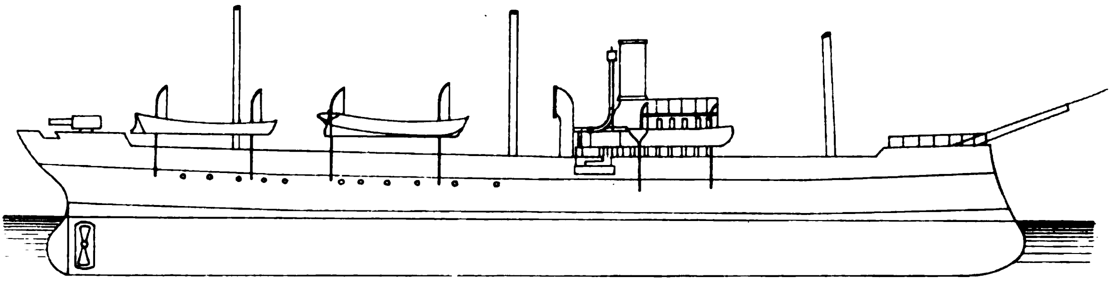
HANHART, LITH

Pl. 90.

FRENCH SHIPS.

"Roland."



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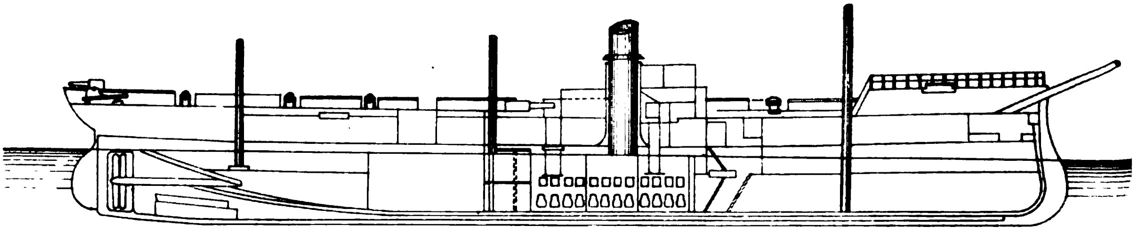
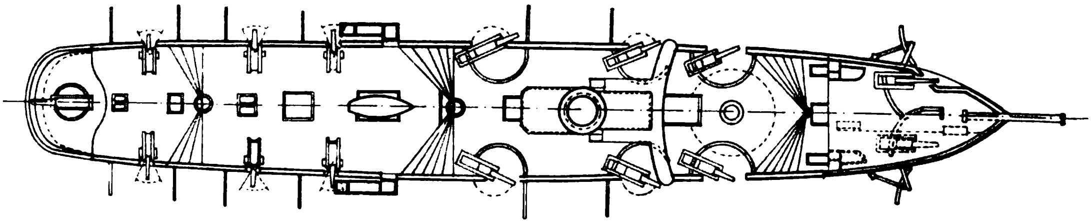
"Villars."



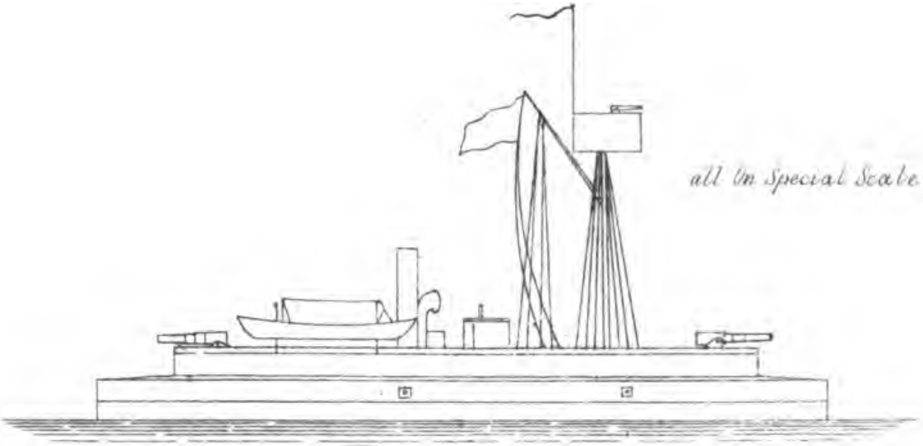
"Villars."
(Upper Deck.)



HANHART, LITH

"Arquebuse."

all On Special Scale



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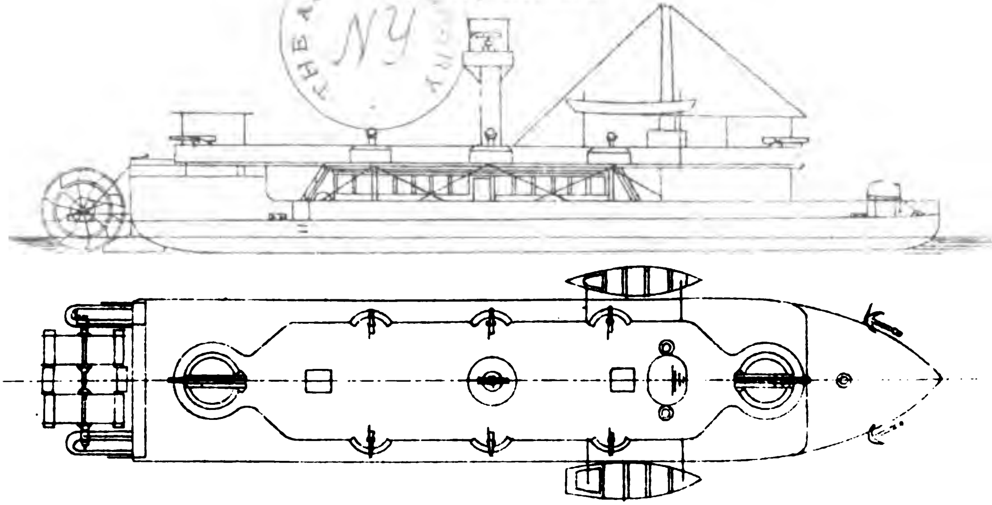
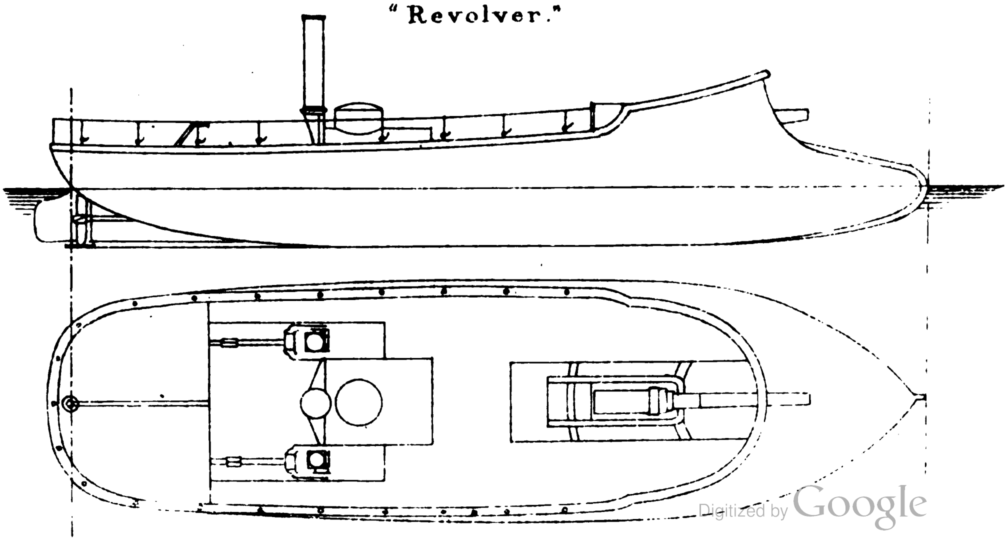
"Henry Riviere."



"Revolver."



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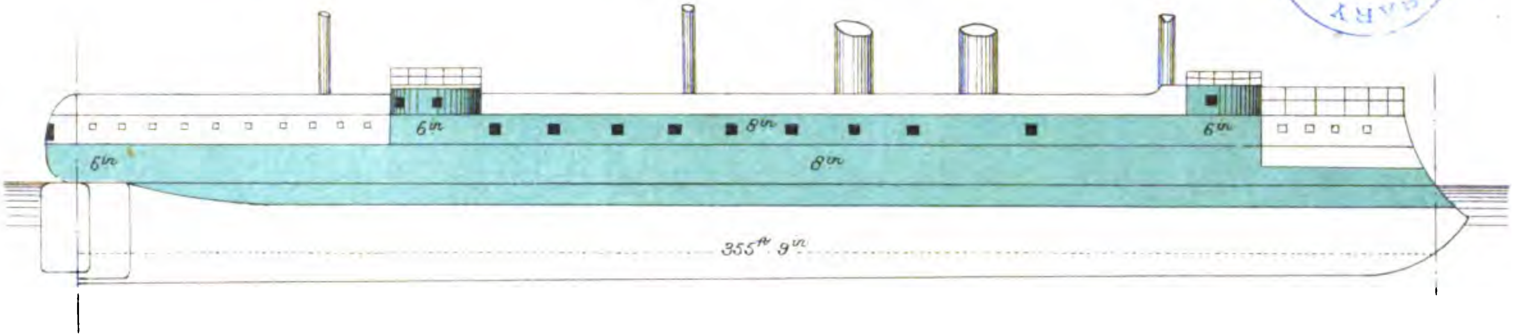
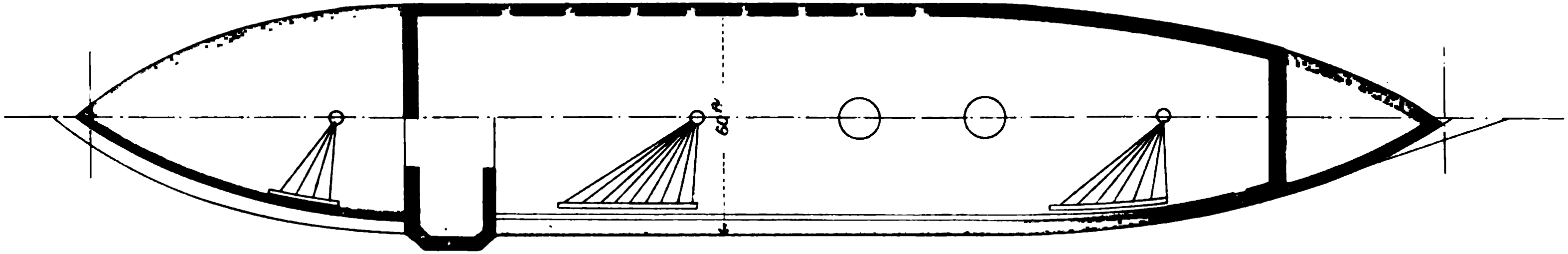
GERMAN SHIPS.

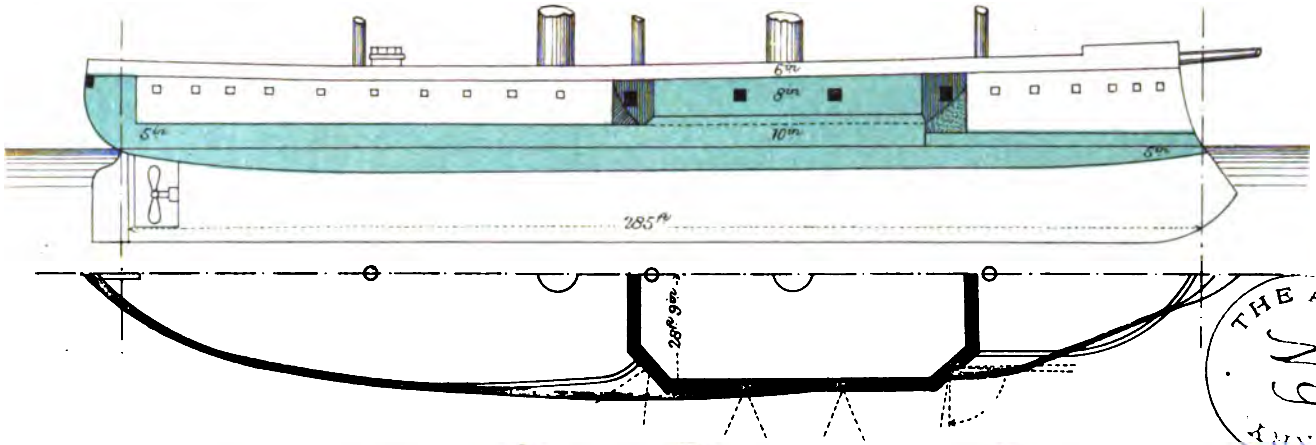
"König Wilhelm."



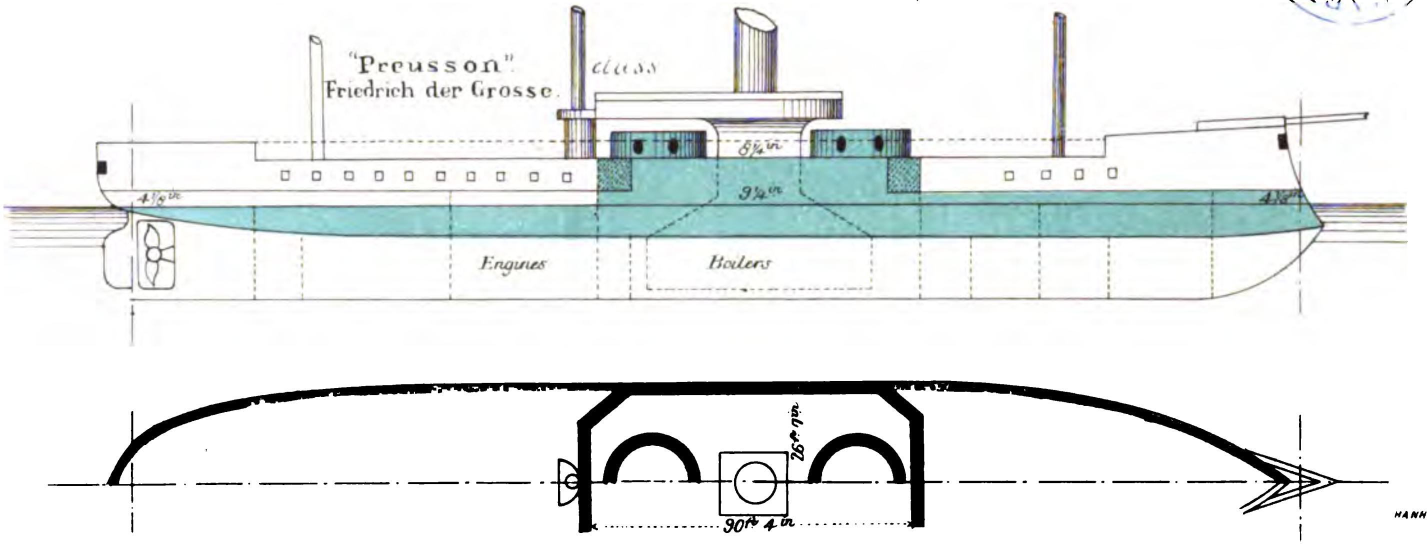


HANHART, LITH.

"Kaiser"
"Deutschland".



"Preusson".
Friedrich der Grosse. class



HANHART, LITH

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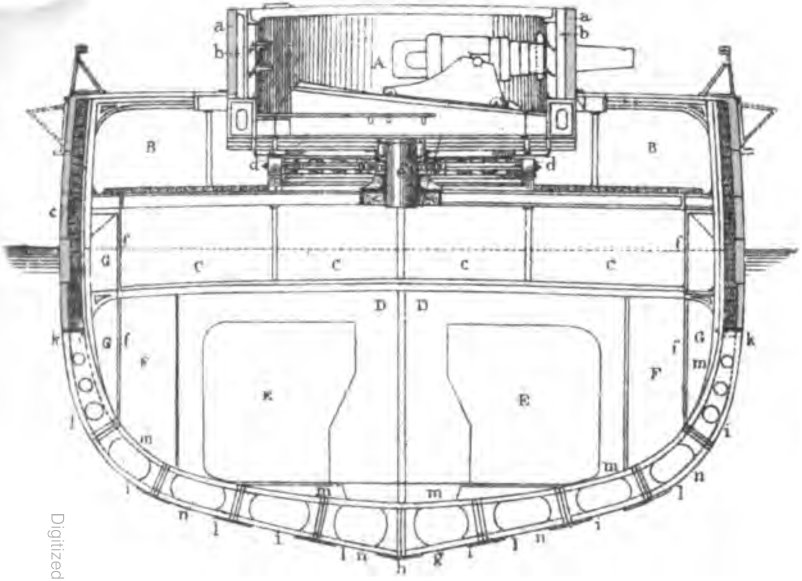
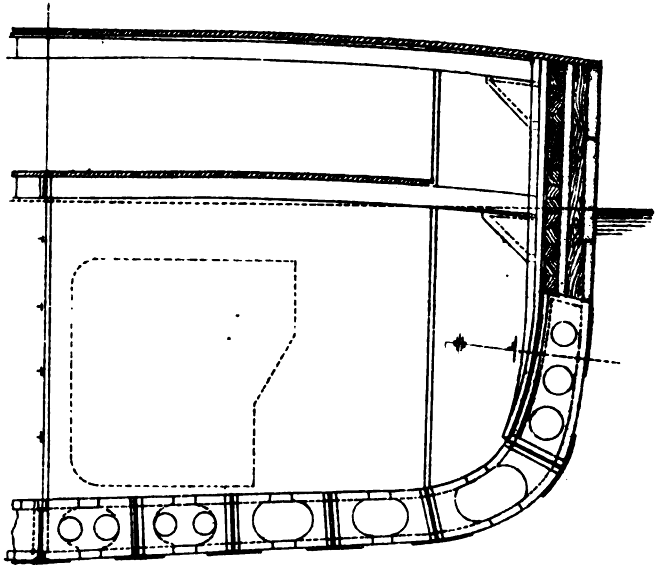
Pl. 94.

GERMAN SHIPS.

Section through turret.

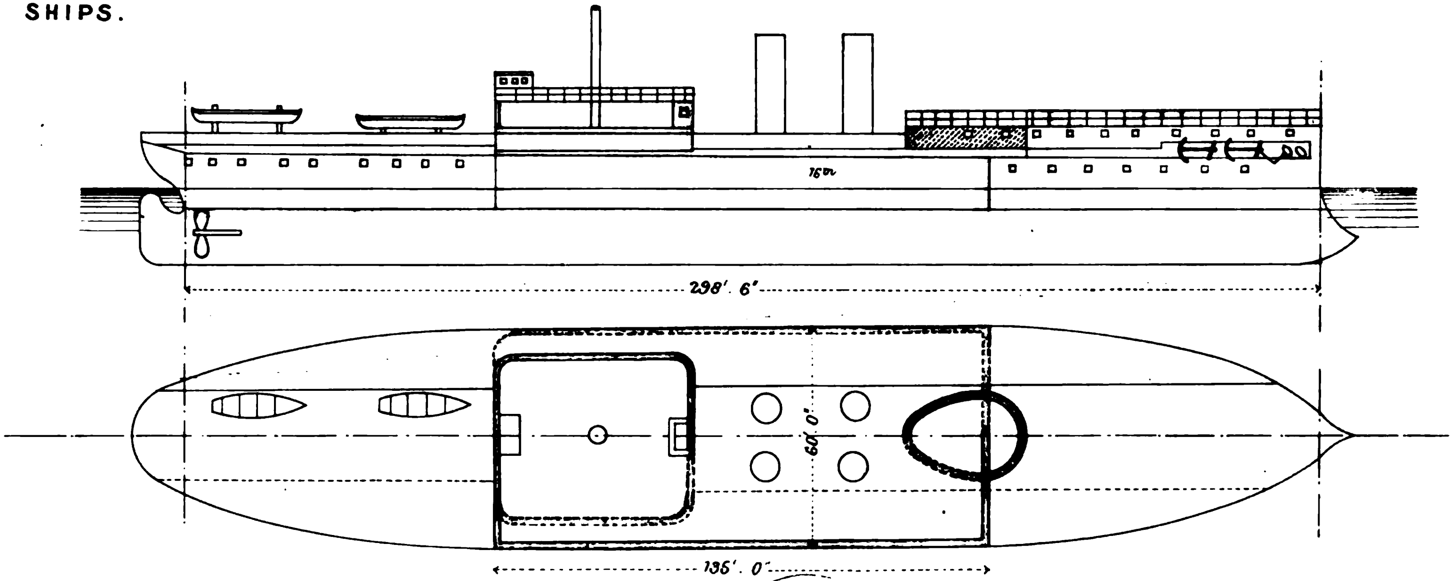


Half Midship Section "Sachsen".



LIBRARY

"Sachsen."



THE A
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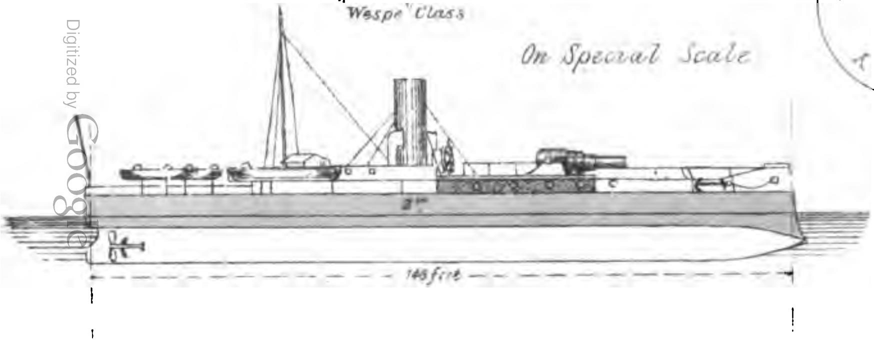
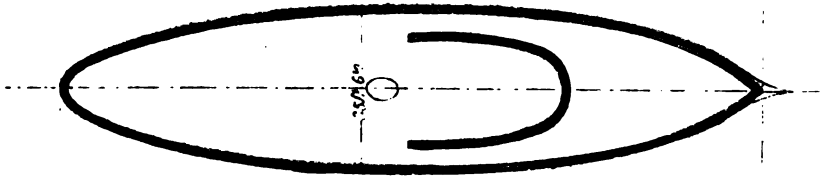
Armoured Gun Boat

"Wespe" Class

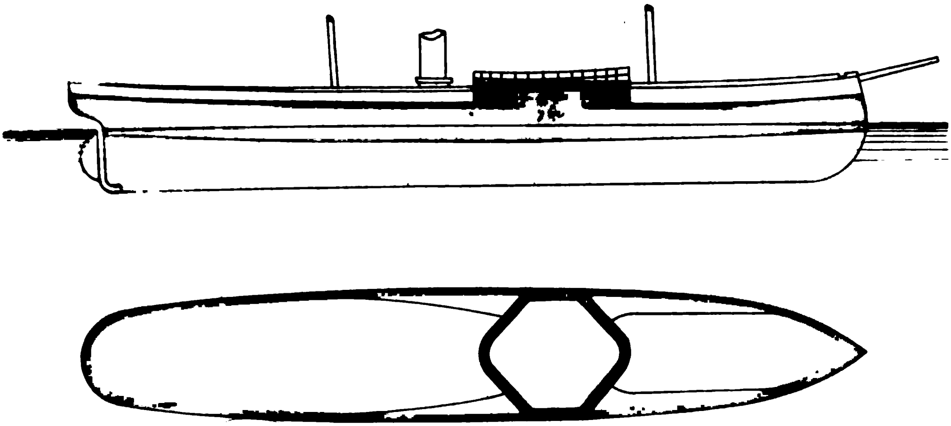
On Special Scale





GREEK SHIPS.

"King George."



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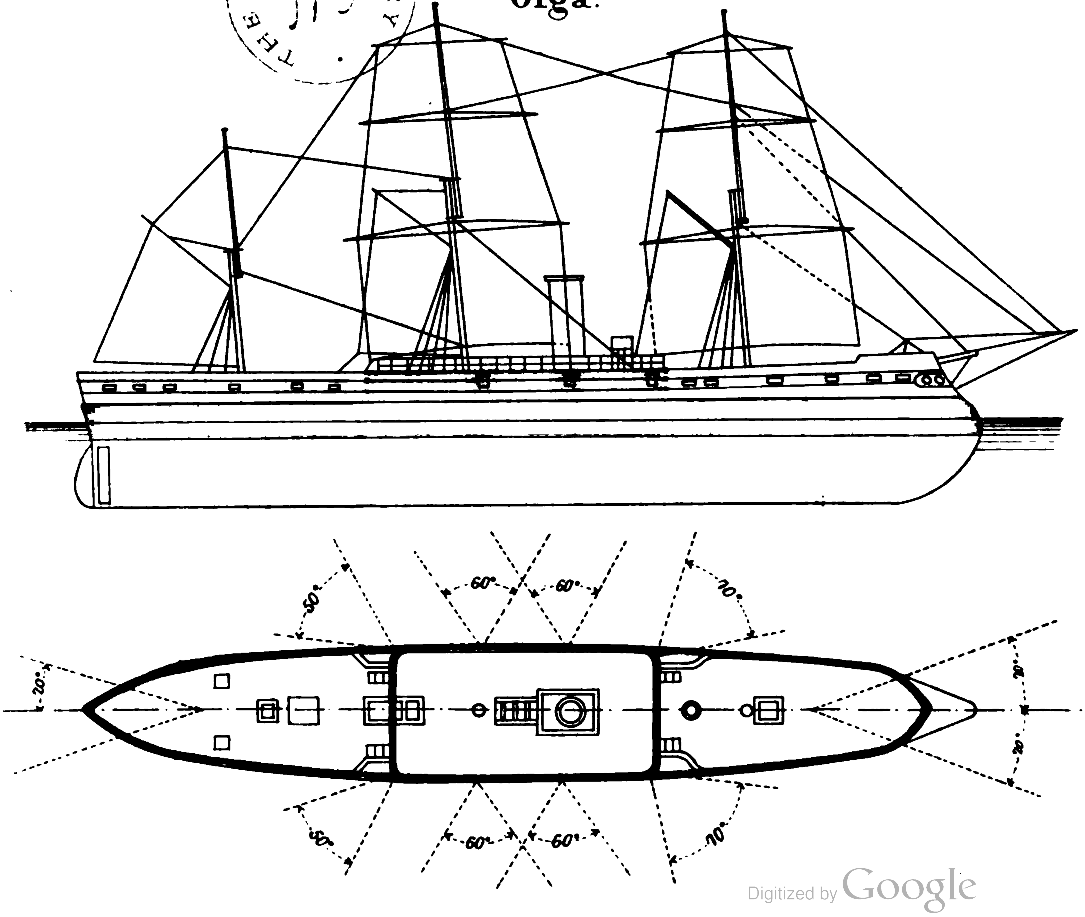
"Olga."



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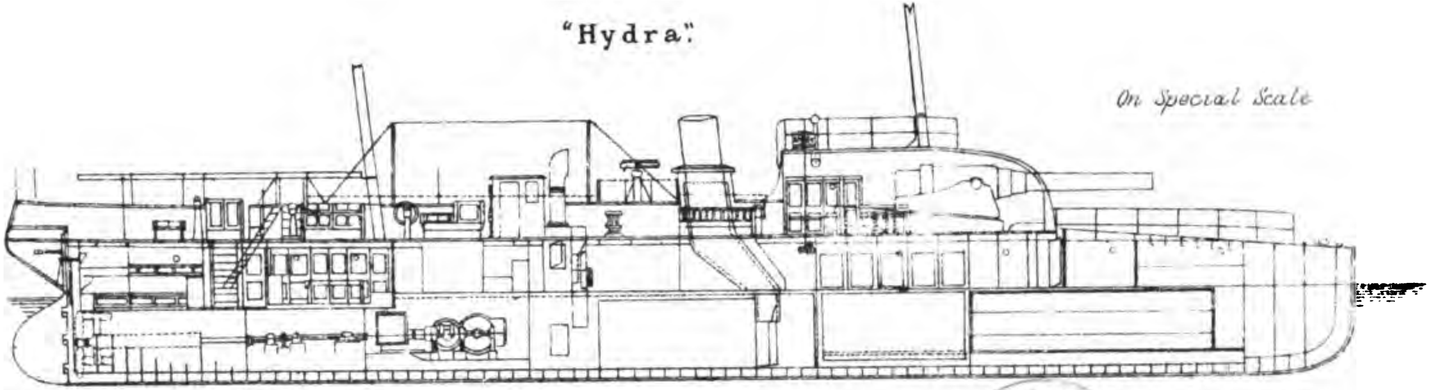
GREEK SHIPS.

"Hydra."

On Special Scale



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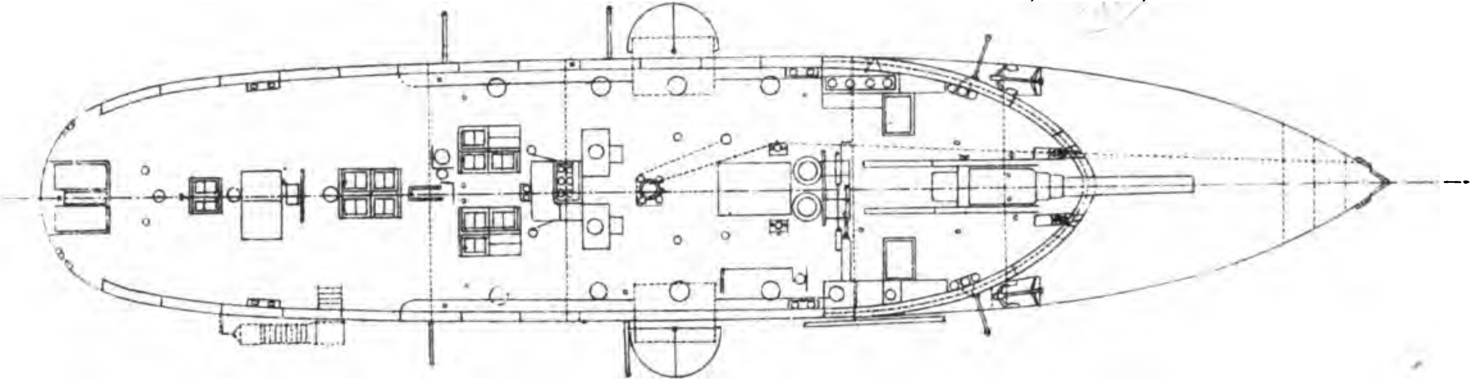
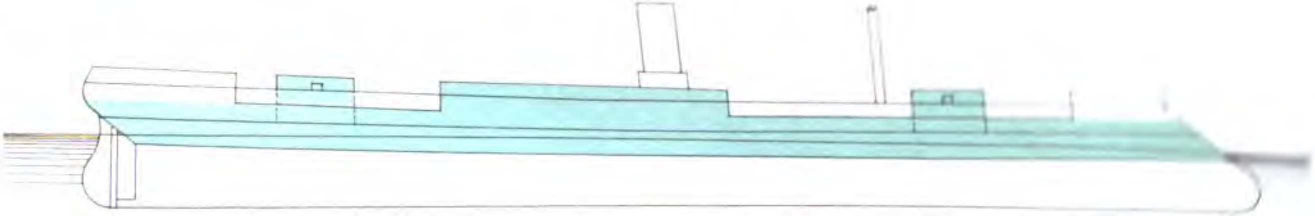
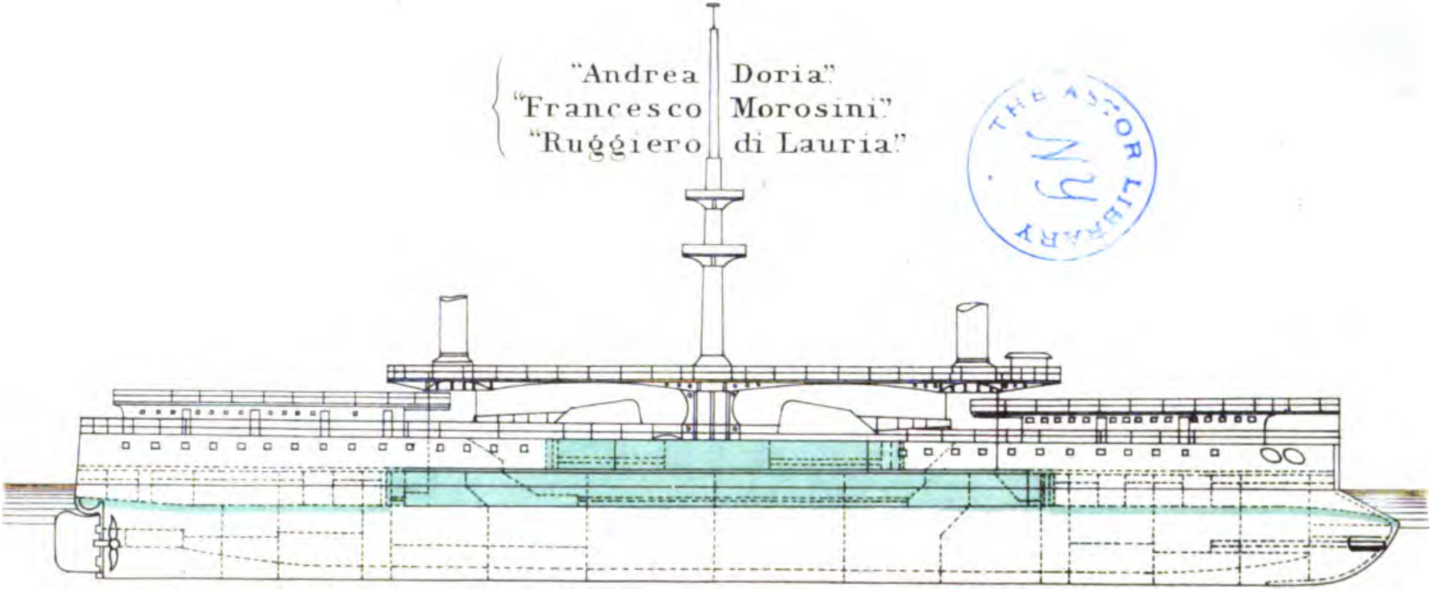


ITALIAN SHIPS.

"Affondatore."





"Andrea Doria."
"Francesco Morosini."
"Ruggiero di Lauria."

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HANHART, LITH

ITALIAN SHIPS.

"Duilio."
"Dandolo."

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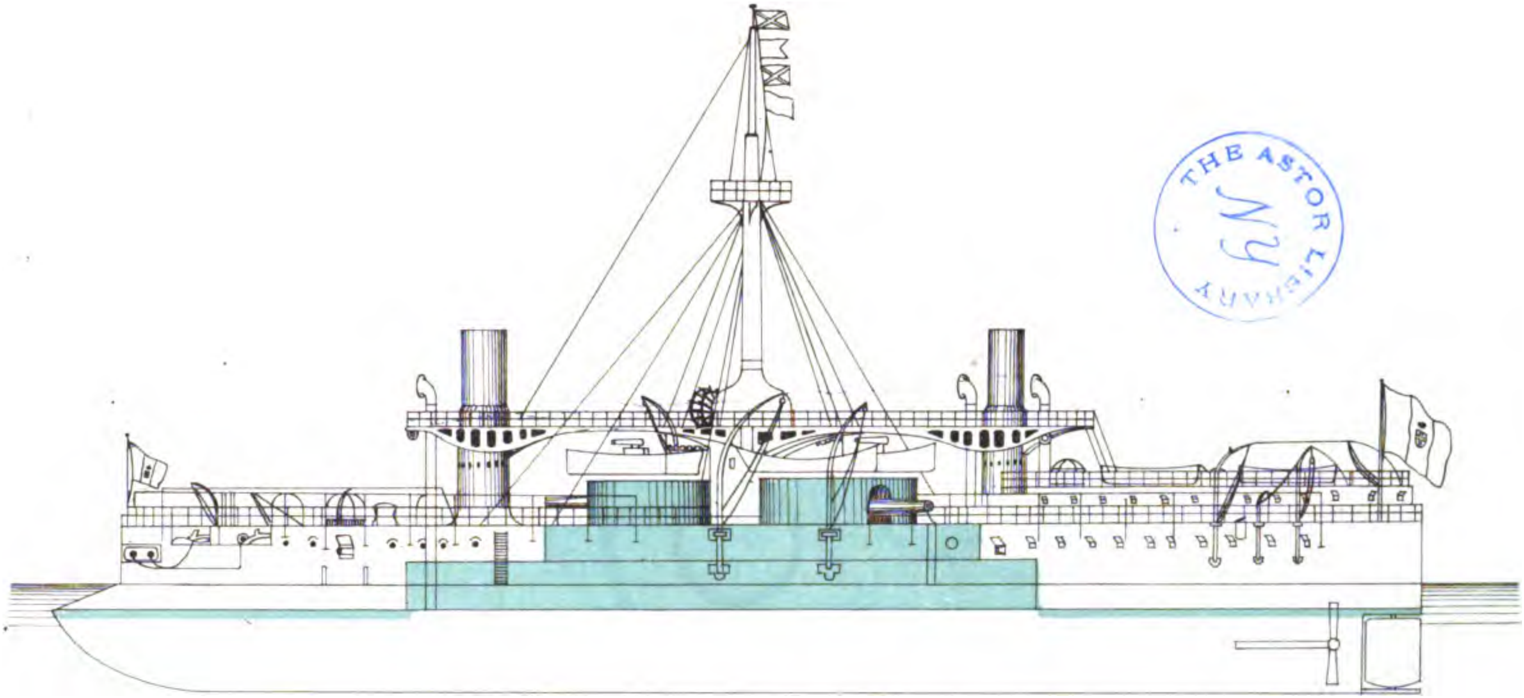
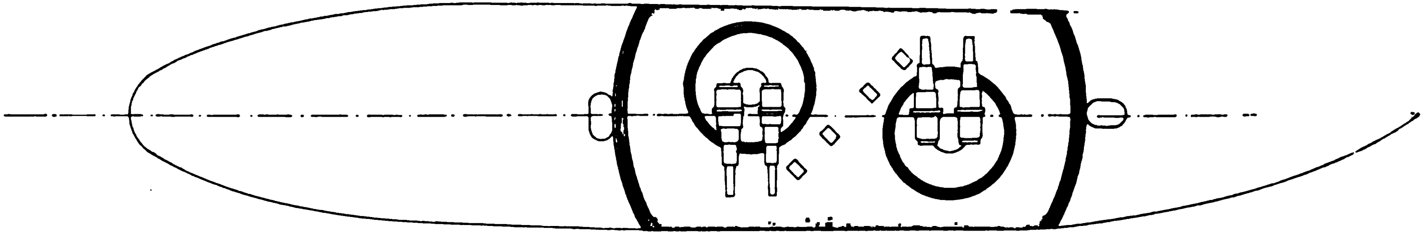


HANHART, LITH

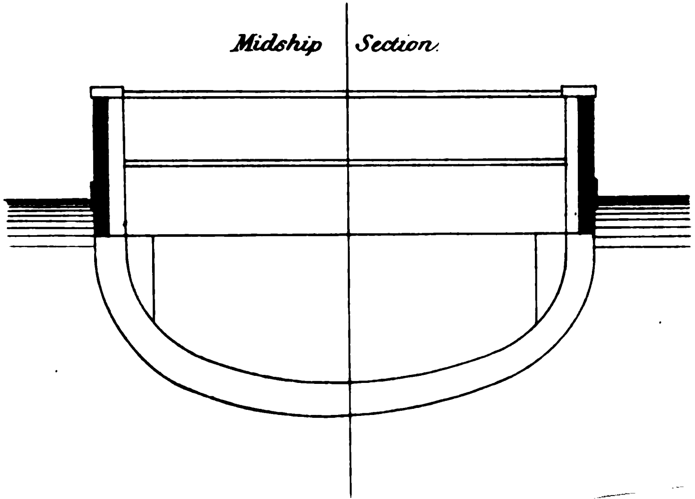
ITALIAN SHIPS

Duilio & Dandolo

Deck Plan



Midship Section



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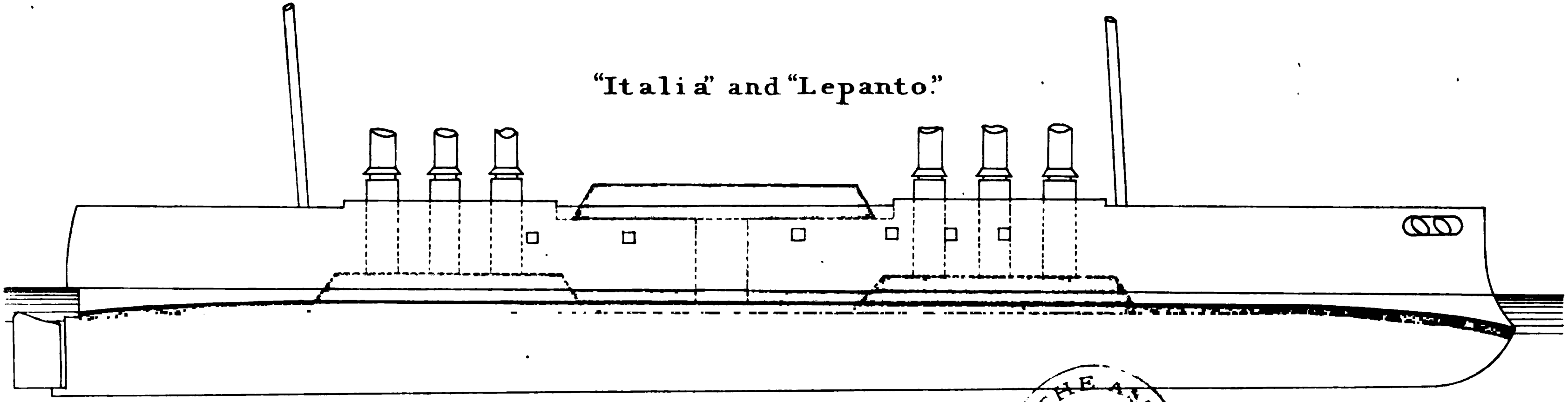
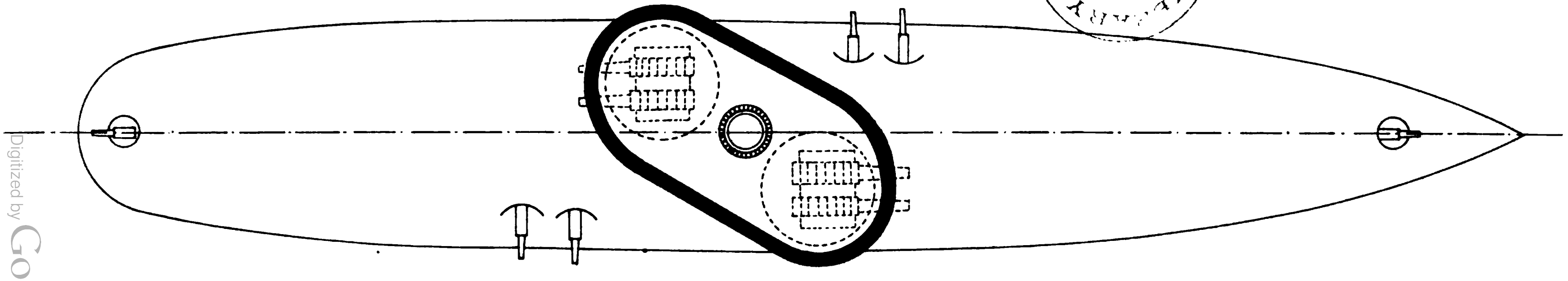
HANHART, LITH

ITALIAN SHIPS.

"Italia" and "Lepanto."



Upper Deck.



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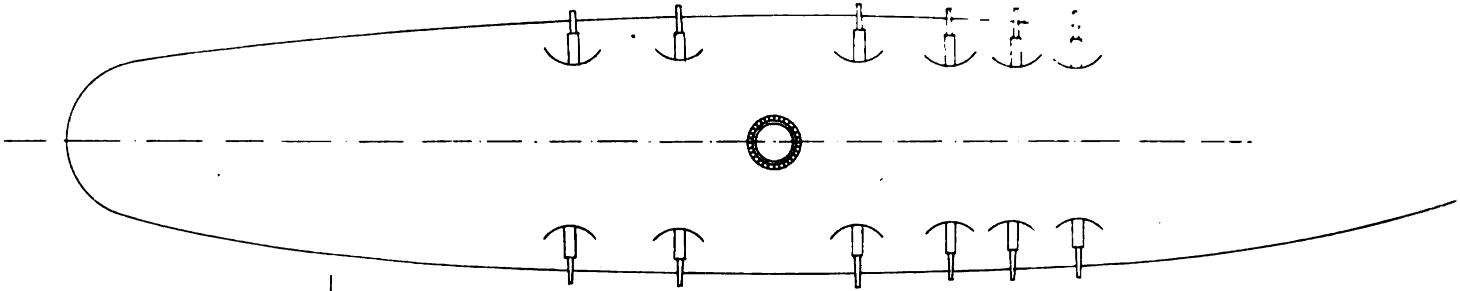
HANHART, LITH.

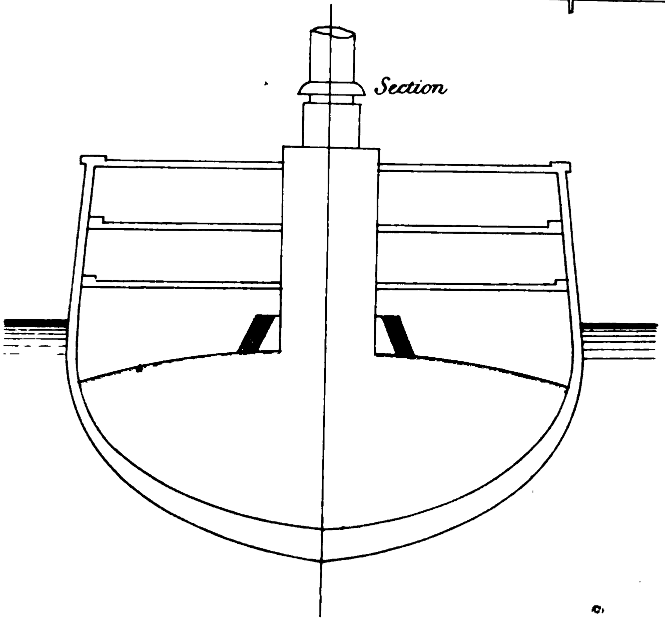
ITALIAN SHIPS

"Italia"

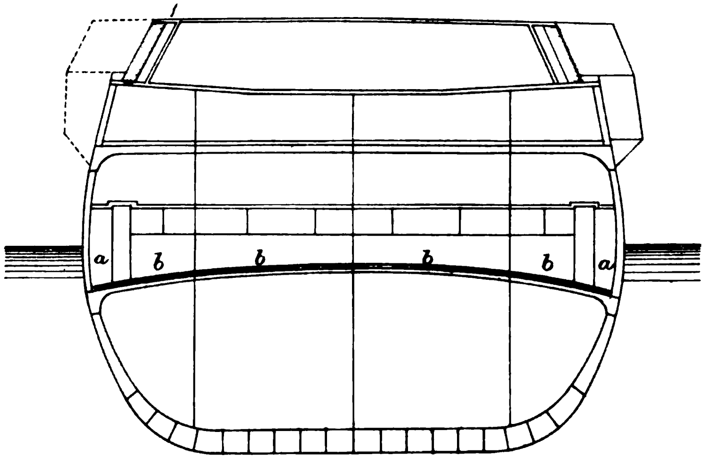
Main Deck



Section



Section.



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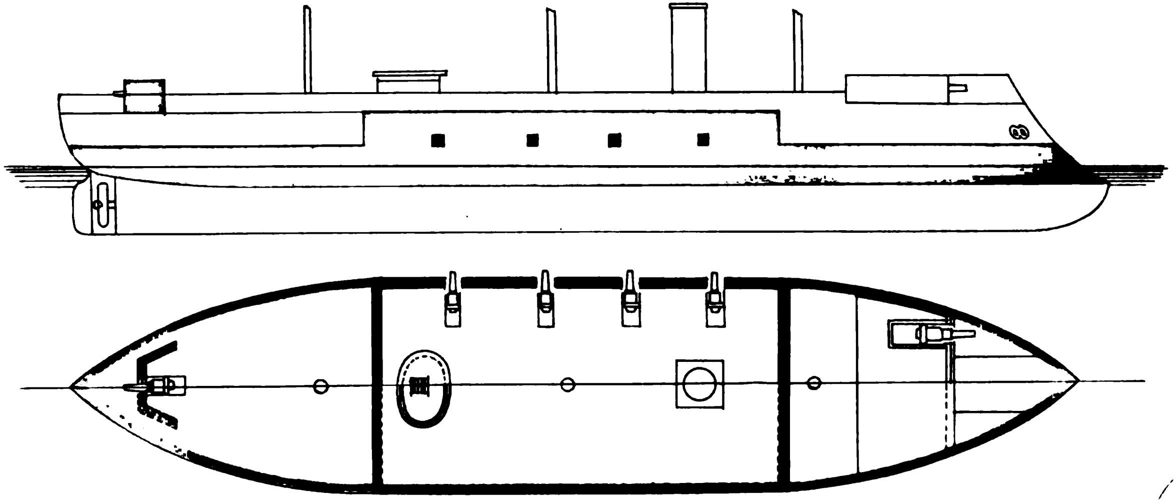
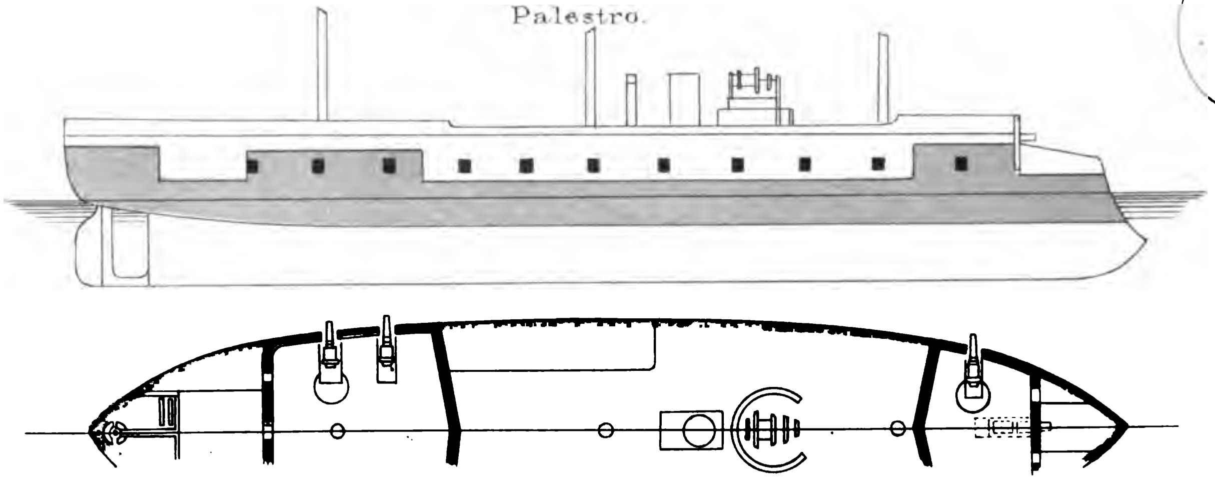
HANHART, LITH

ITALIAN SHIPS.

Maria Pia.



Palestro.

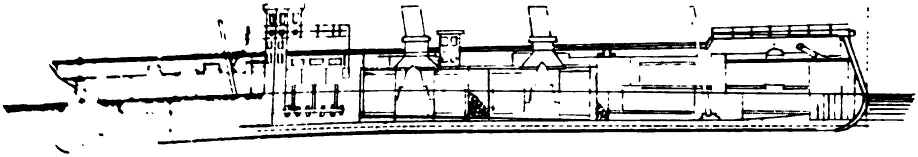


HANHART LITH.

Pl. 104.

ITALIAN SHIPS

Agostino Barbarigo.
Unarmoured Despatch Vessel.



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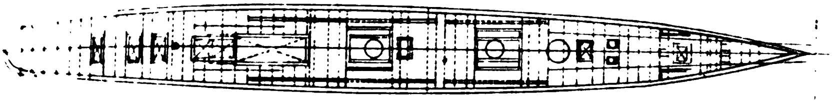
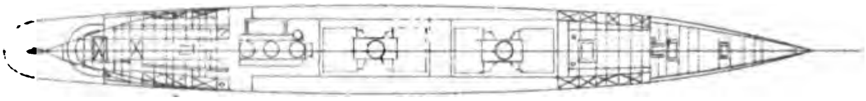
Upper Deck



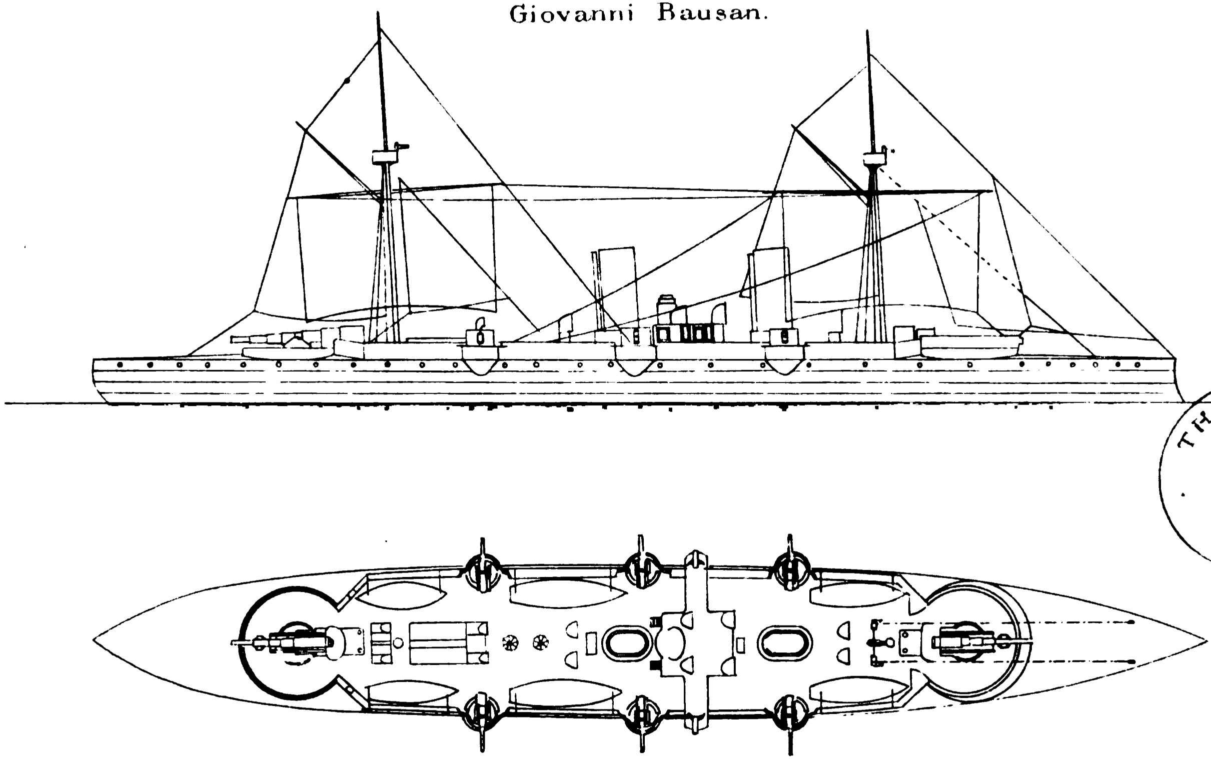
Between Decks.



Pl. 105

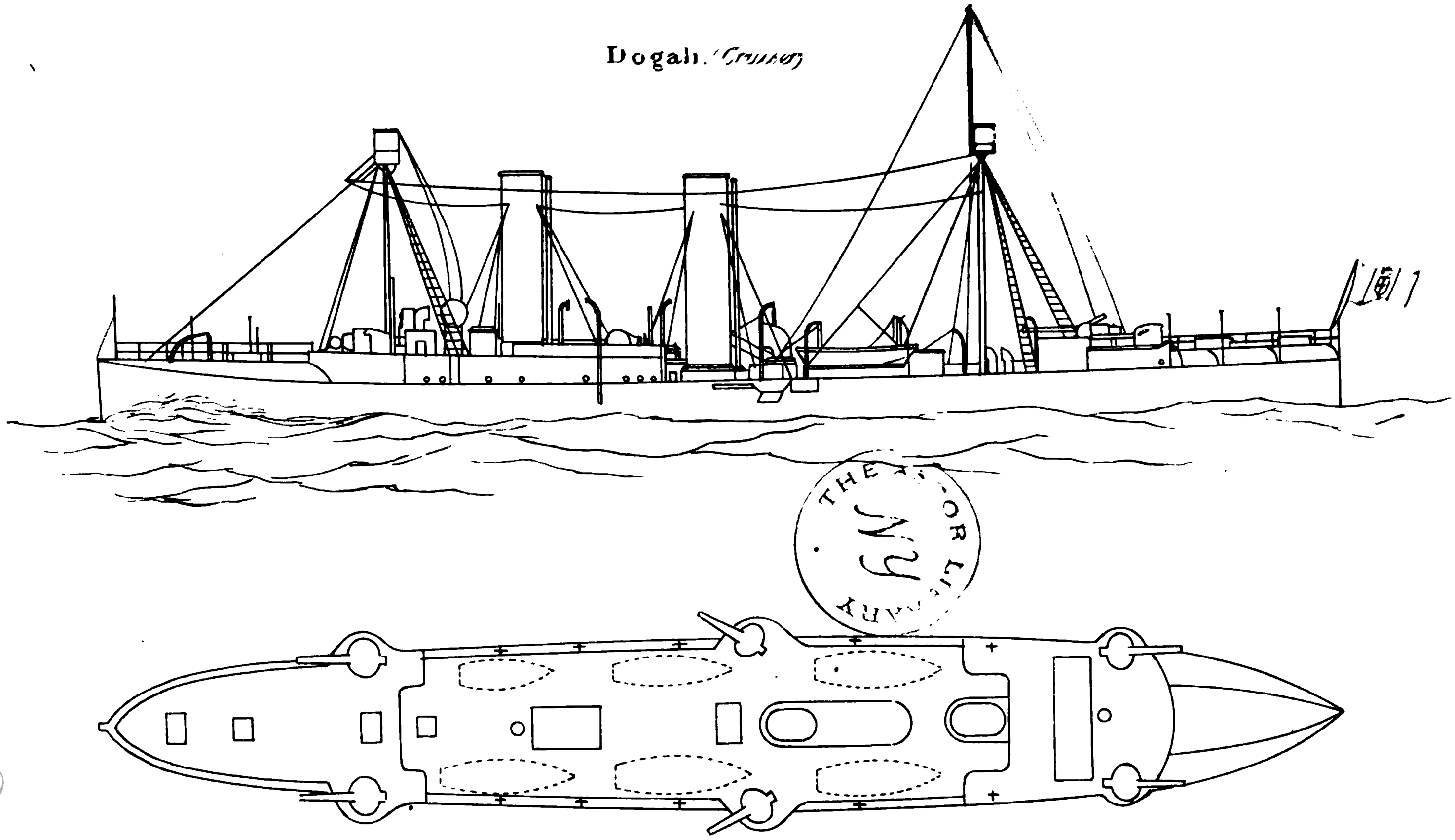
ITALIAN SHIPS.

Giovanni Bausan.



HANHART, LITH.

Dogali. (Cruiser)



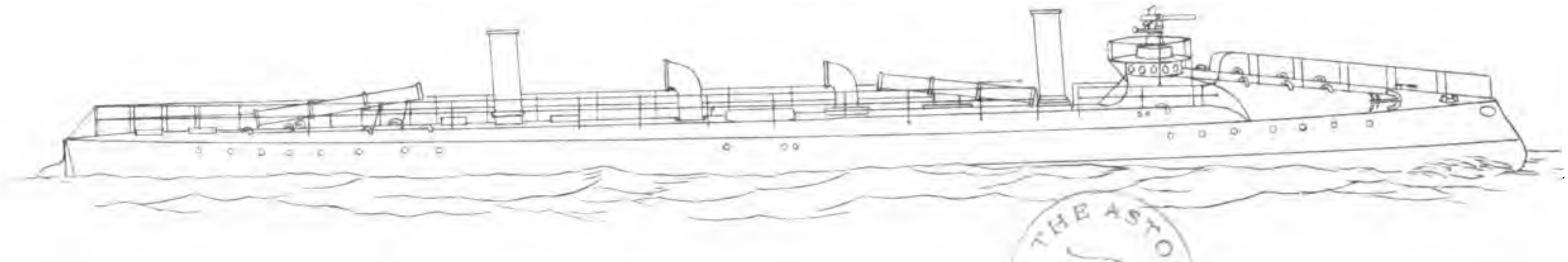
HANHART, LITH.

Pl. 107.

ITALIAN SHIPS.

On Special Scale.

Twin-Screw Torpedo Boat.



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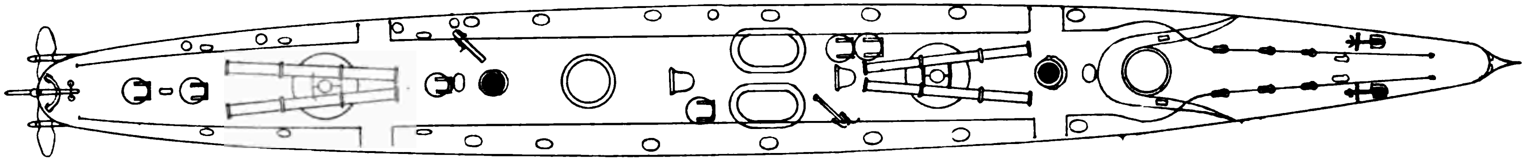


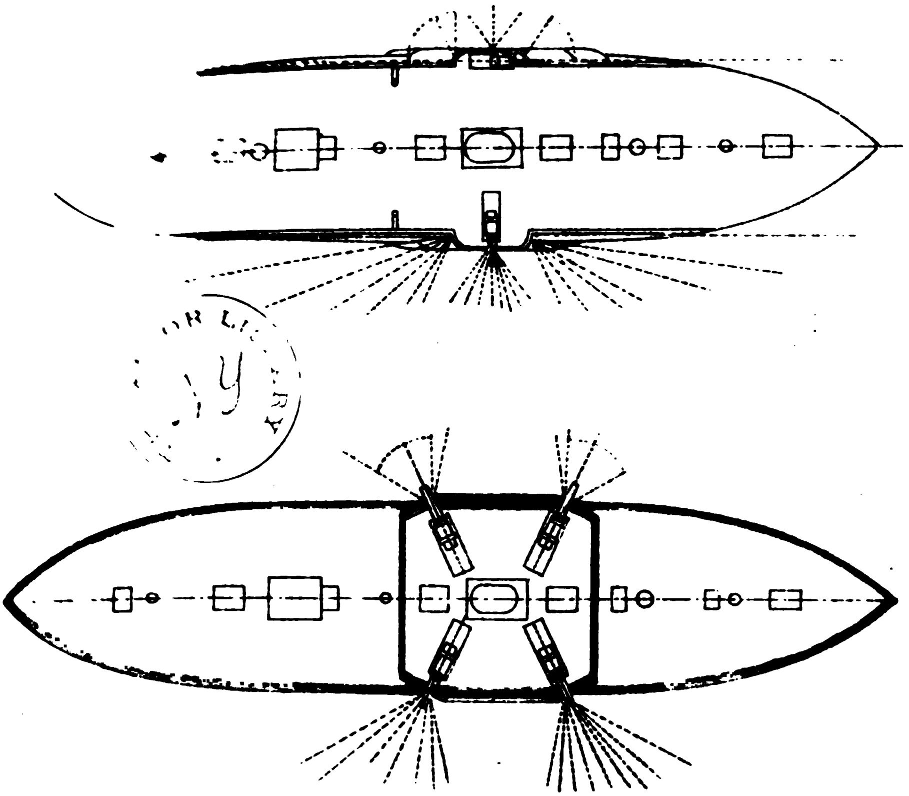
HANHART, LITH

Pl. 108.

Pl. 108

JAPANESE SHIPS.

"Fu-Soo."



OR LI
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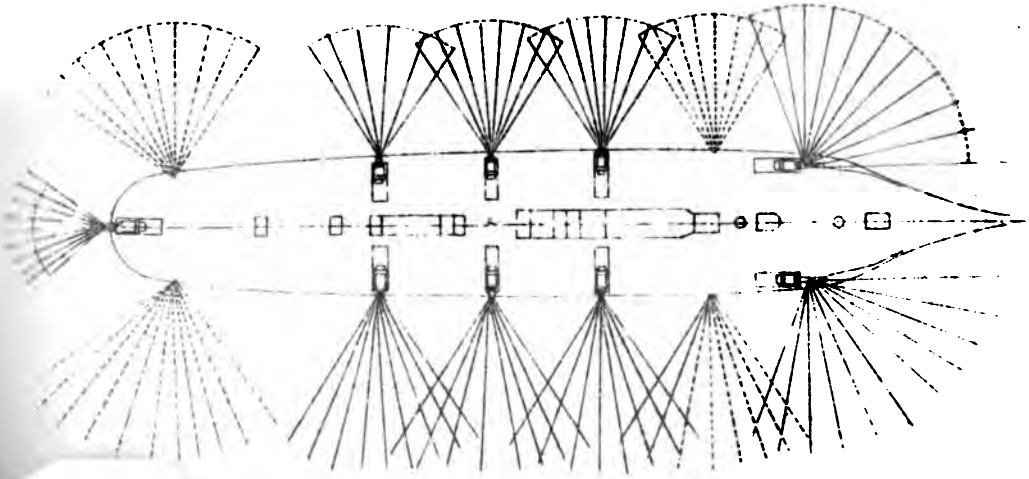
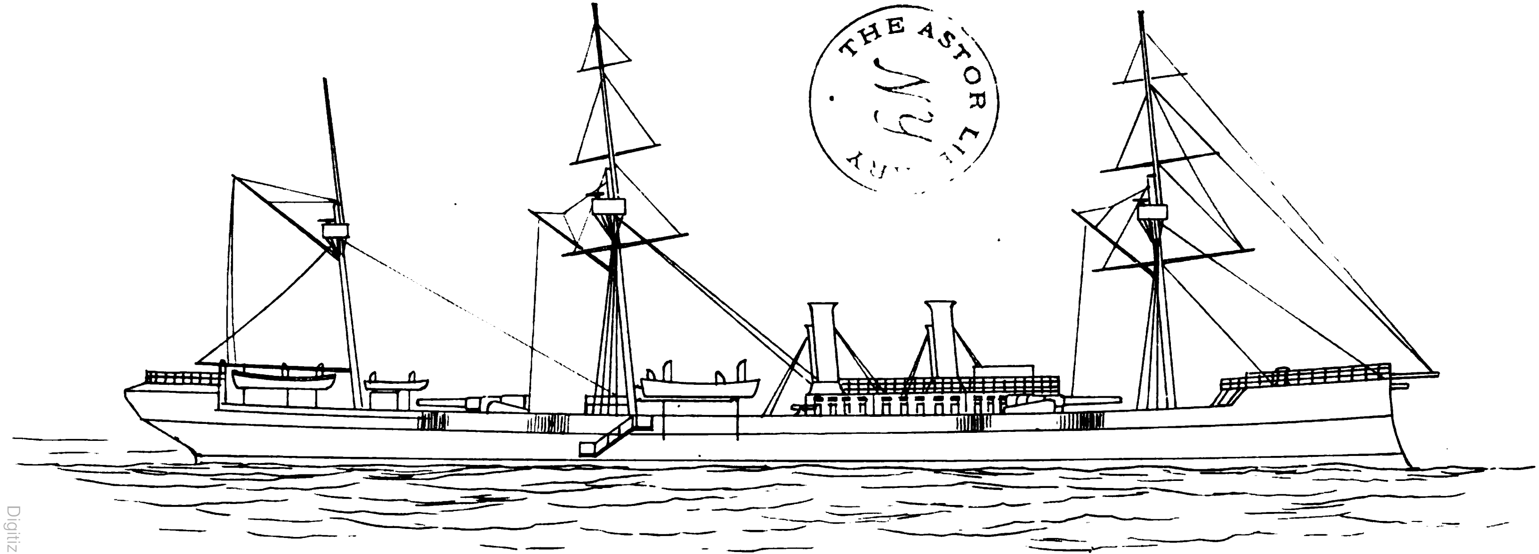
"Hi-yei" & "Kin-go."



Pl. 108a.

JAPANESE SHIPS.

"Unebi."



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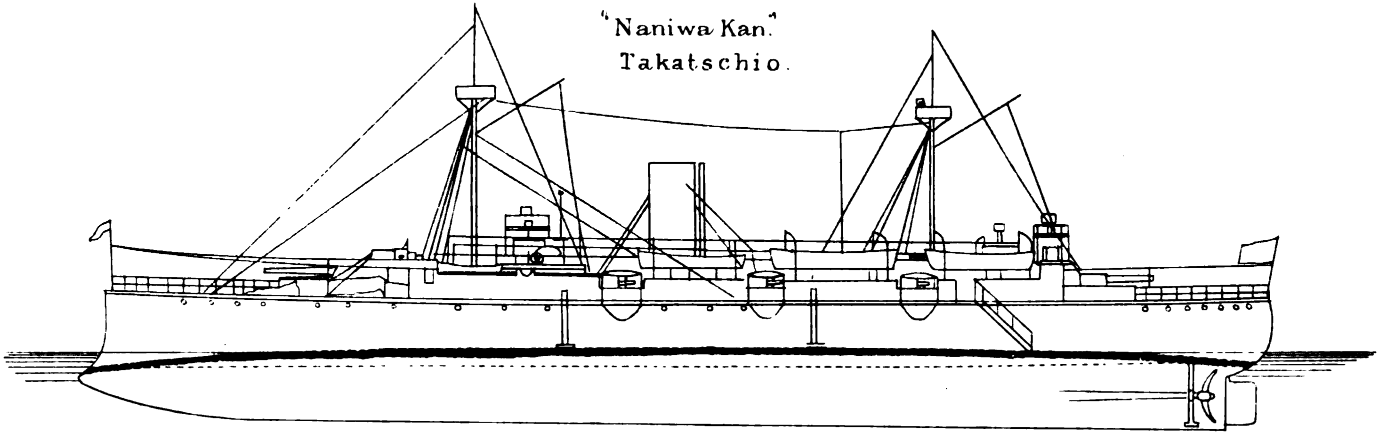
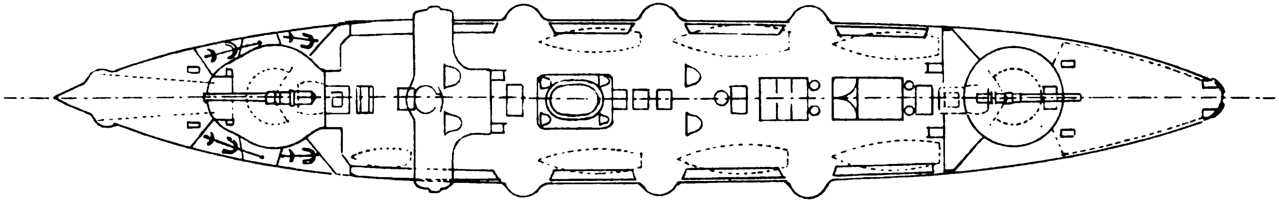
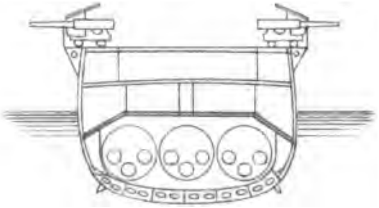
Pl. 109.

JAPANESE SHIPS.

"Naniwa Kan."
Takatschio.







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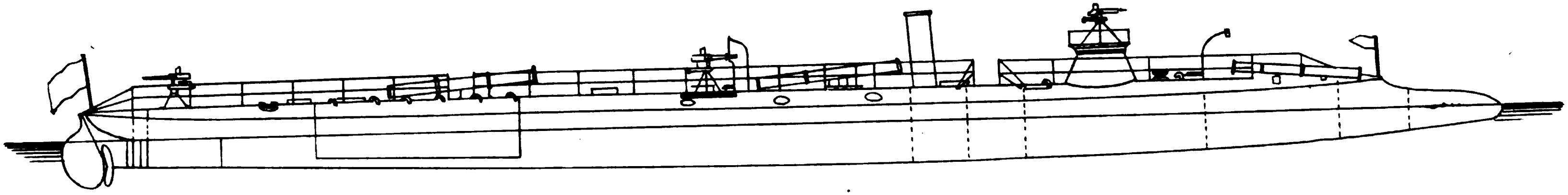
HANHART, LITH

On Special Scale.

JAPANESE SHIPS.

Yarrow Torpedo Boat.



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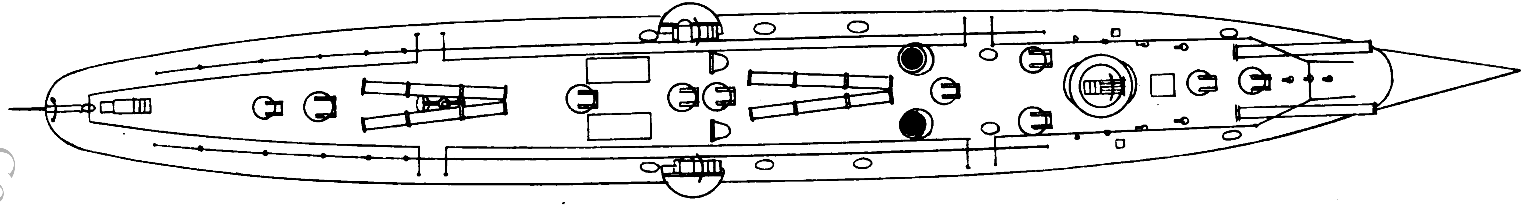
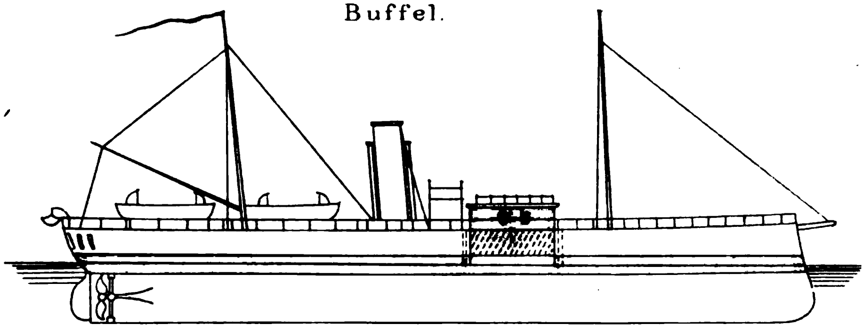


HANHART, LITH.

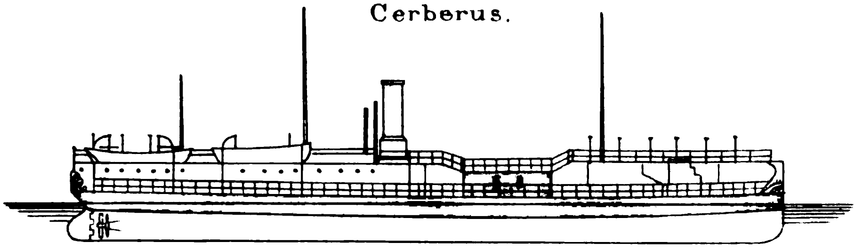
Pl. 11.

NETHERLANDS GOVT SHIPS.

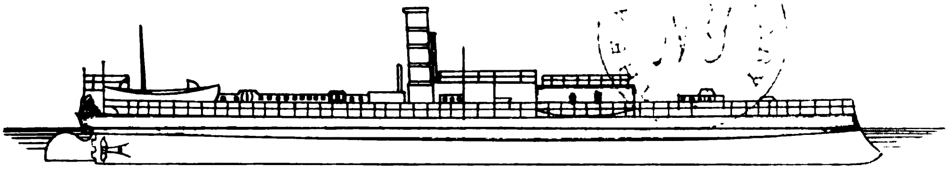
Buffel.



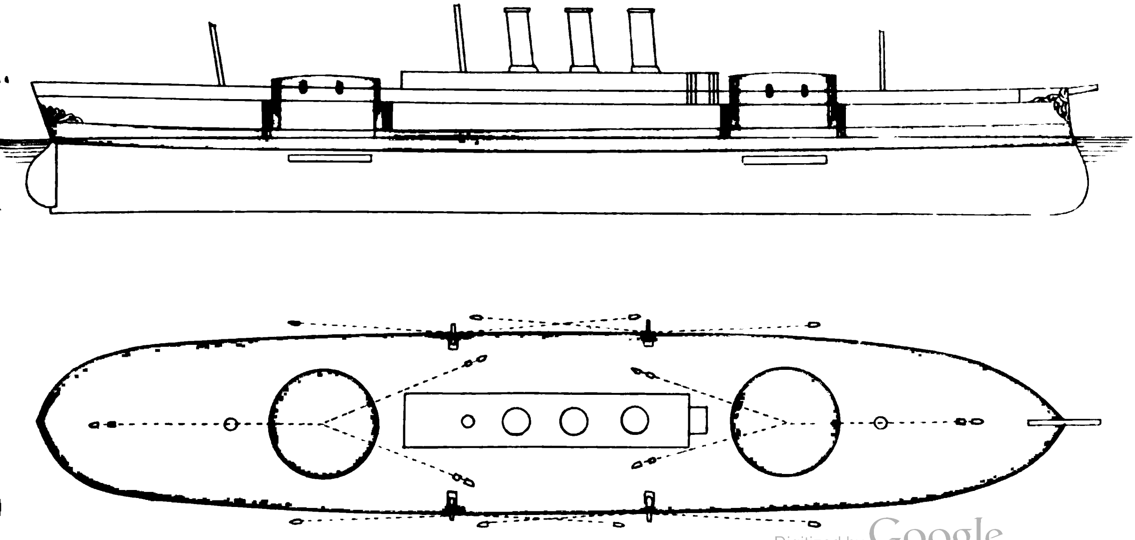
Cerberus.



Draak.



Koning der Nederlander.

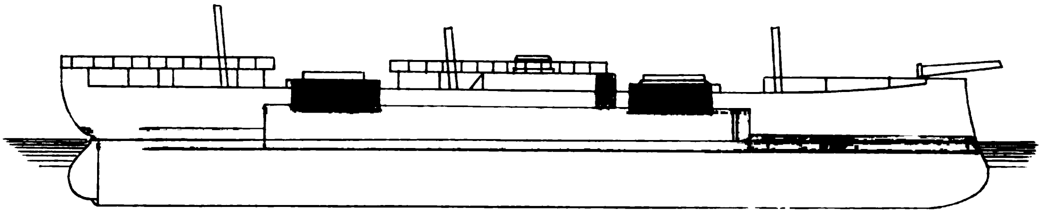


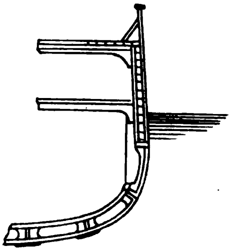
HANHART, LITH

Pl. 112.

NETHERLANDS GOVT SHIPS.

Prinz Hendrik.





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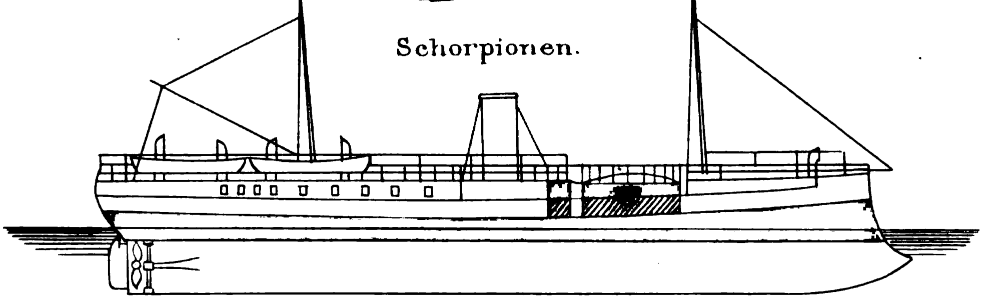
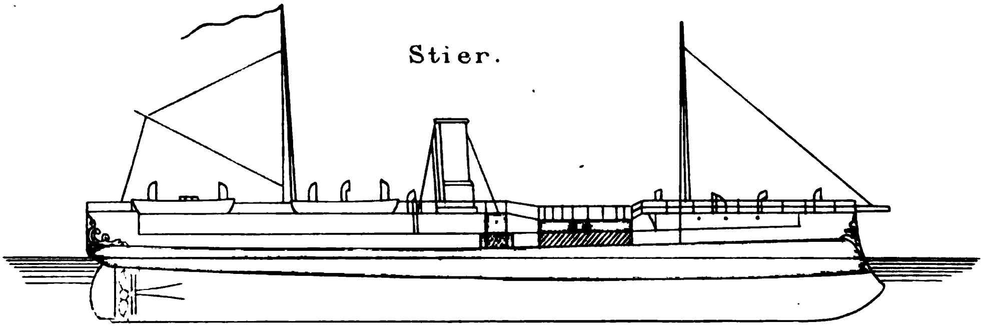
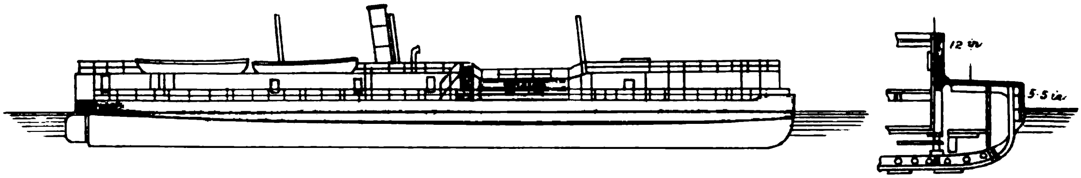
Schorpionen.



Stier.



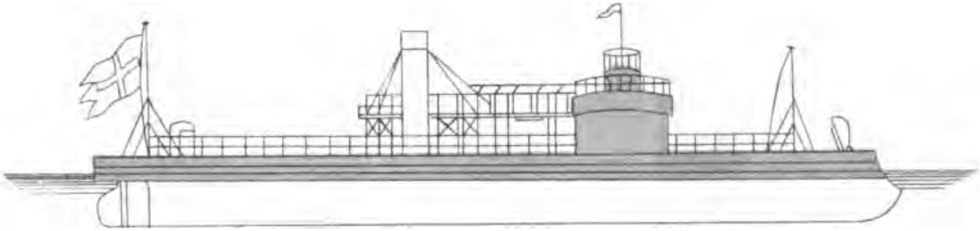
Tijger.



HANHART, LITH.

NORWEGIAN SHIPS.

Mjolner & Thrudvang.



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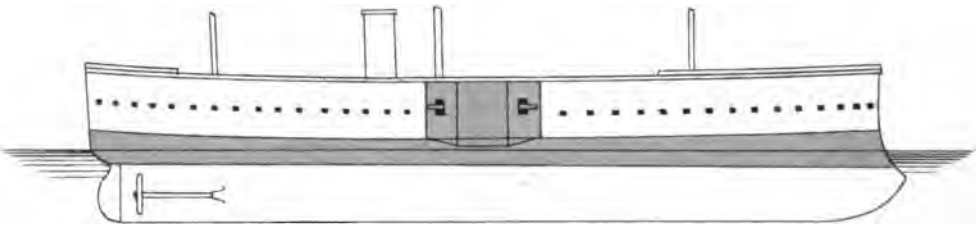
HANHART, LITH.

Pl. 114.

PORTUGUESE SHIPS.

Vasco de Gama.



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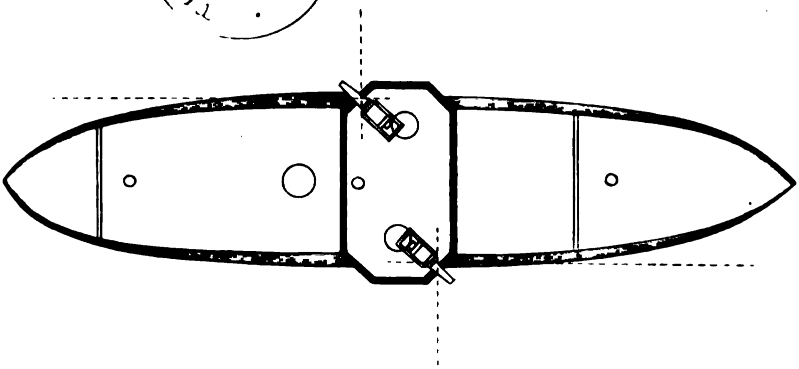
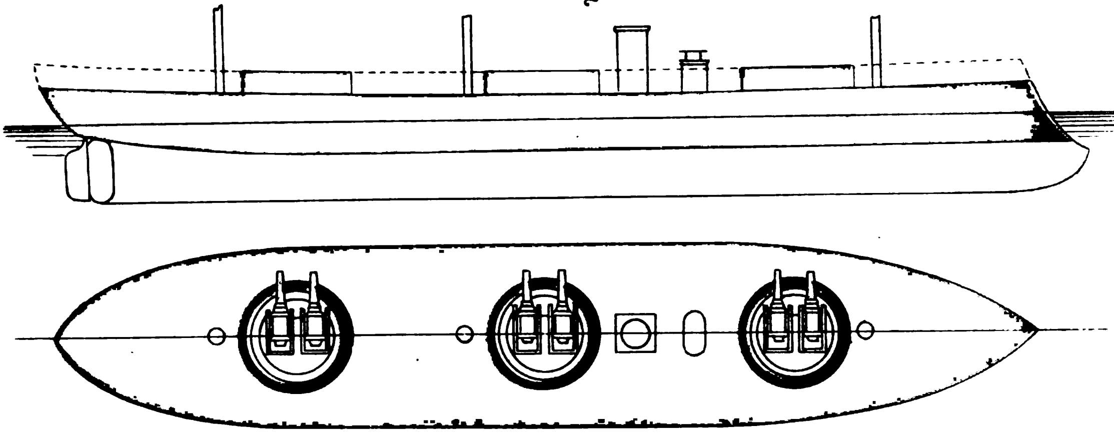


HANNHART, LITH.

Admiral Lazareff.
Admiral Greig.



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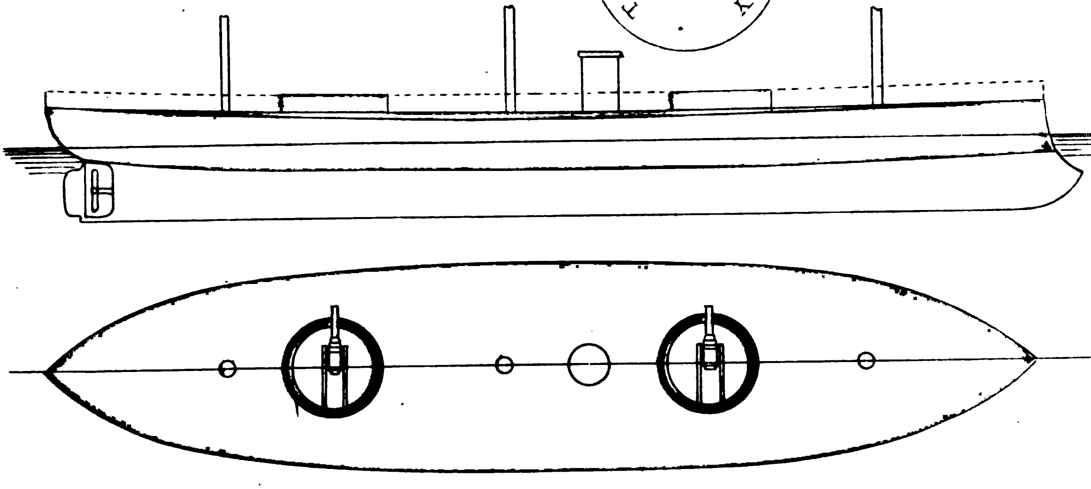
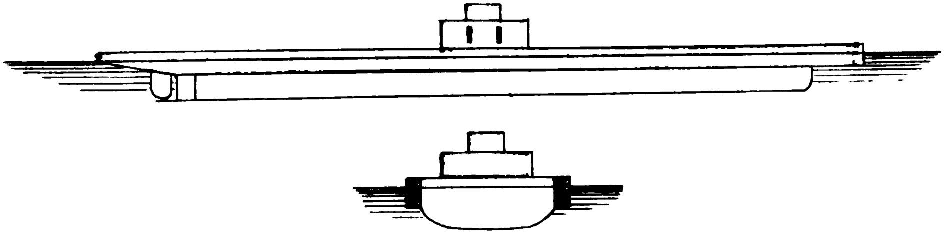
Admiral Spiridoff.



Bronenosetz.
Edinorog.
Koldun.
Latnick.
Perun.
Strelitz.
Veshtchun.
&c



HANHART, LITH

9X 116.

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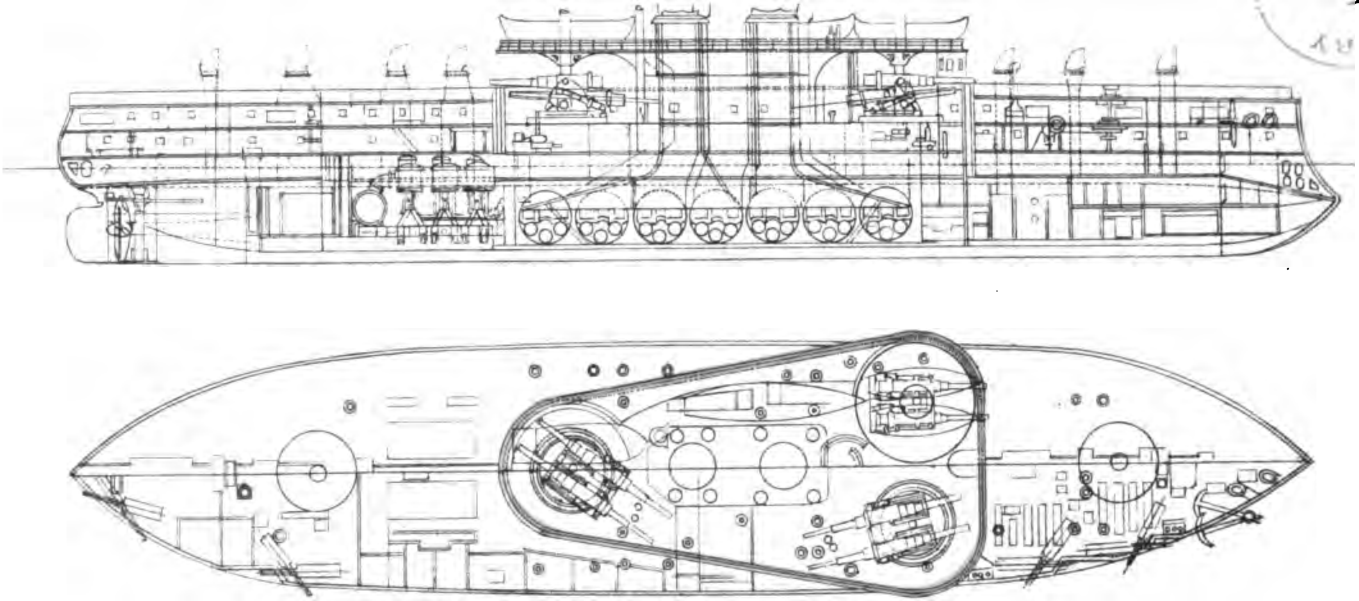
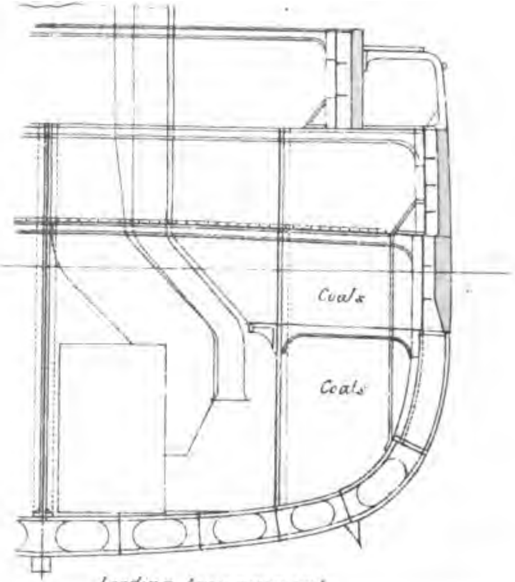
RUSSIAN SHIPS.



"Catherine II".
"Tchsme".
"Sinope".

"Tchesme."
"Sinope."
Catherine II.

RUSSIAN SHIPS



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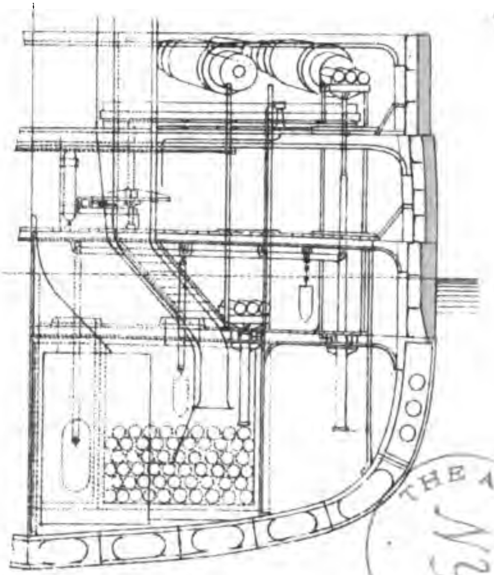

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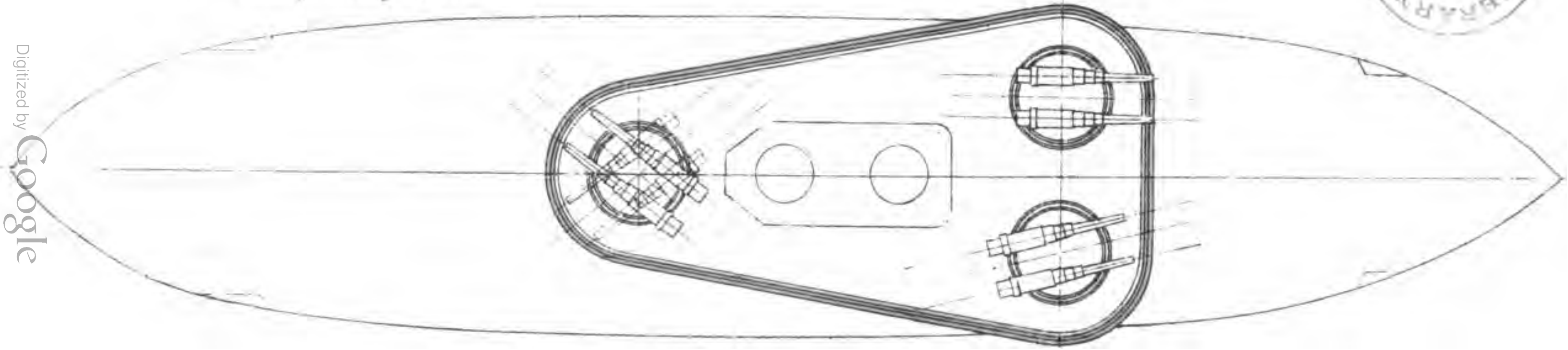
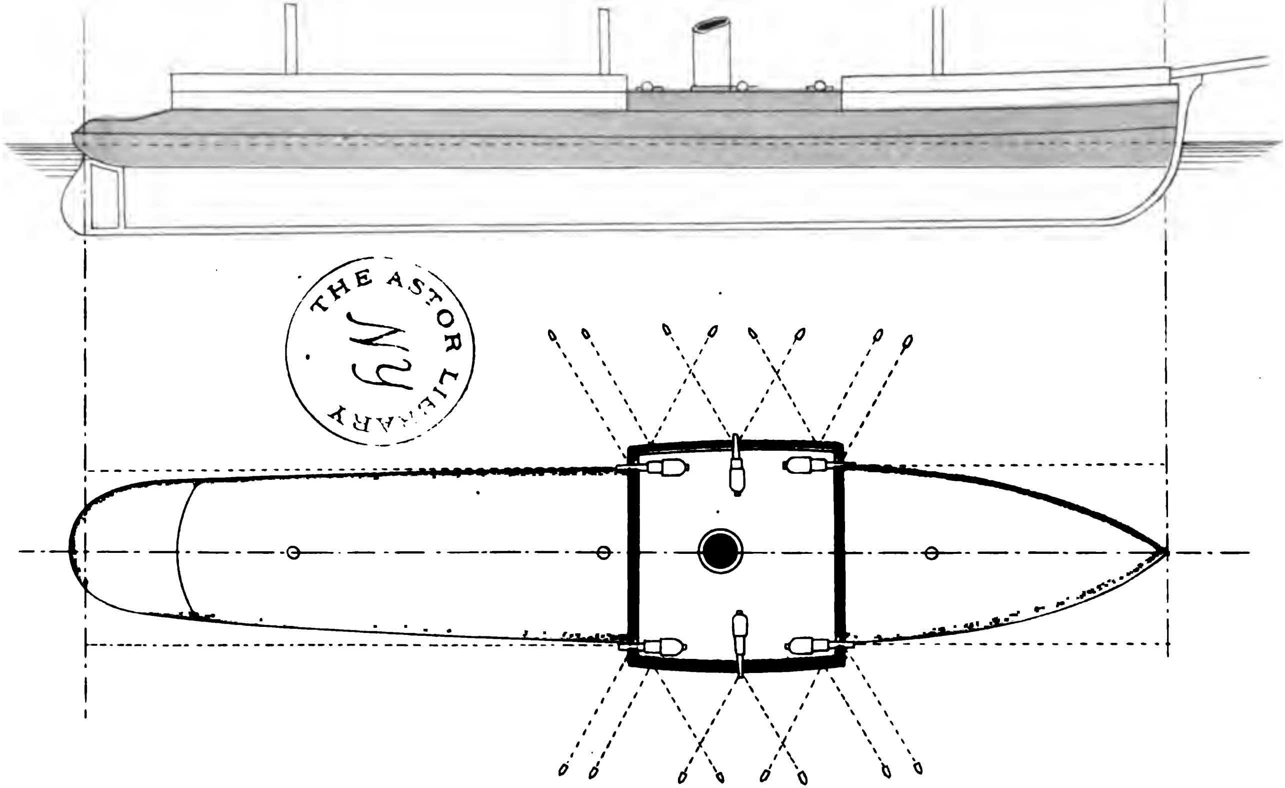


Catherine.II.

Pl. 118.

RUSSIAN SHIPS.

General-Admiral.
Herzog Edinburgski.



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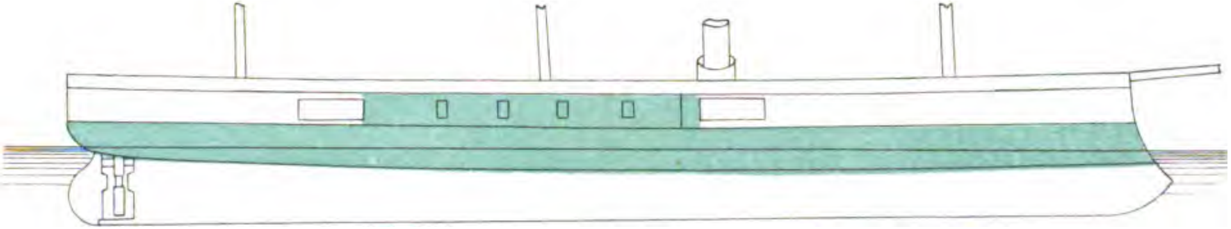
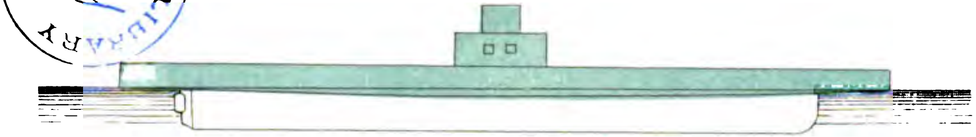
HANHART, LITH

RUSSIAN SHIPS.

"Kniaz Pojarski"



"Lava, Tifun, Uragan" &c.



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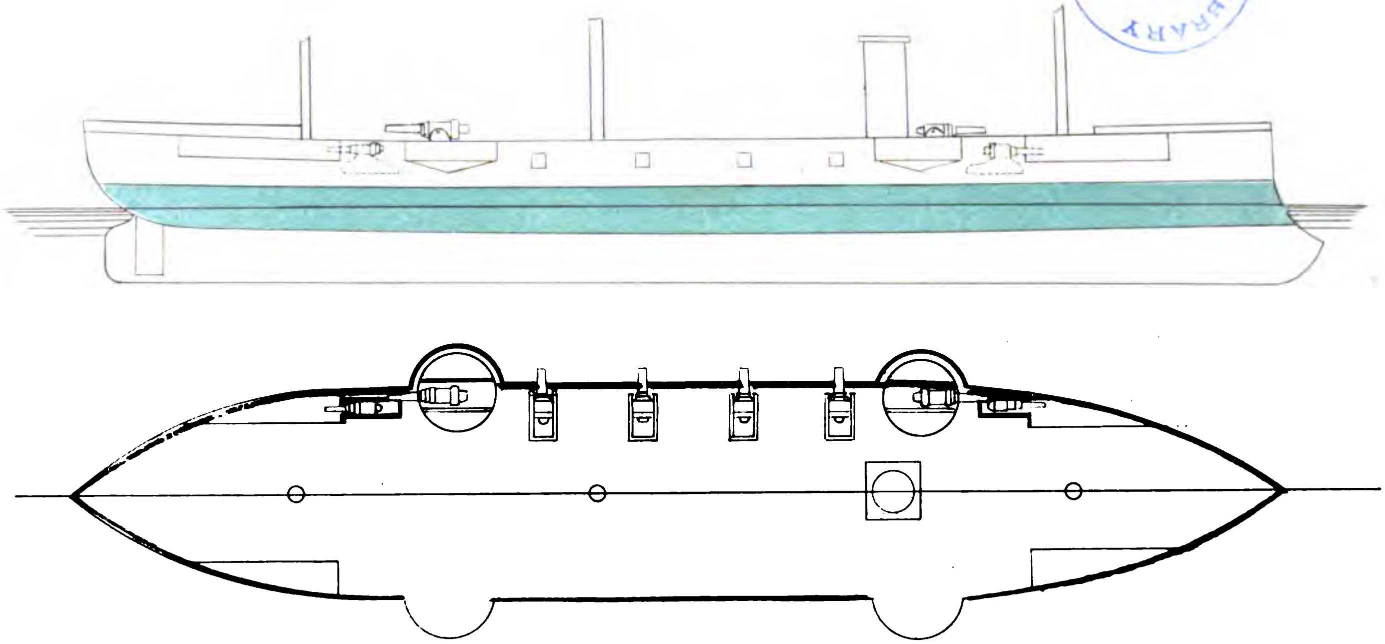
HANHART, LITH

Nº 120.

RUSSIAN SHIPS

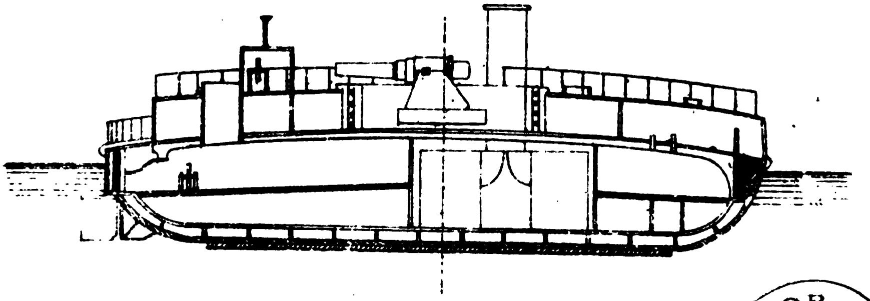
"Minin"

THE ASTOR LIBRARY NY

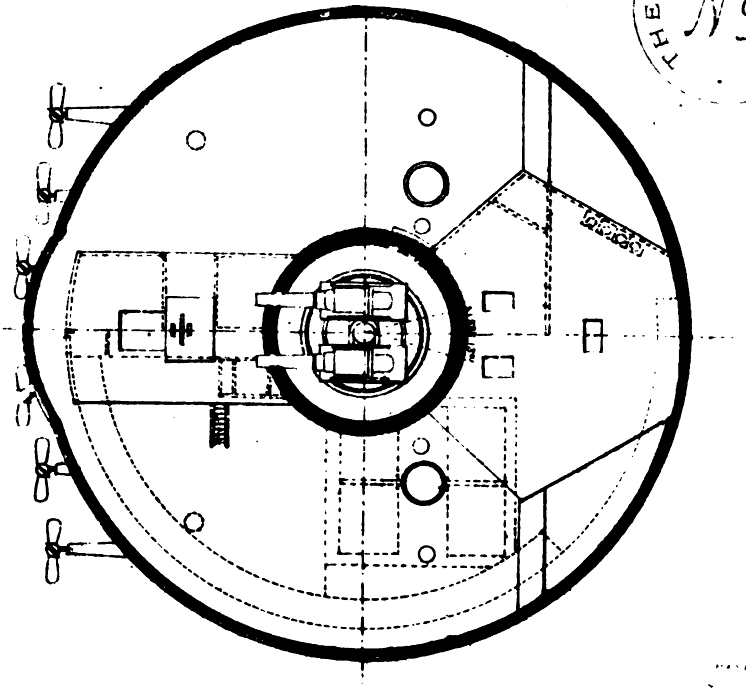


HANHART LITH

"Novgorod", Section.



Plan.



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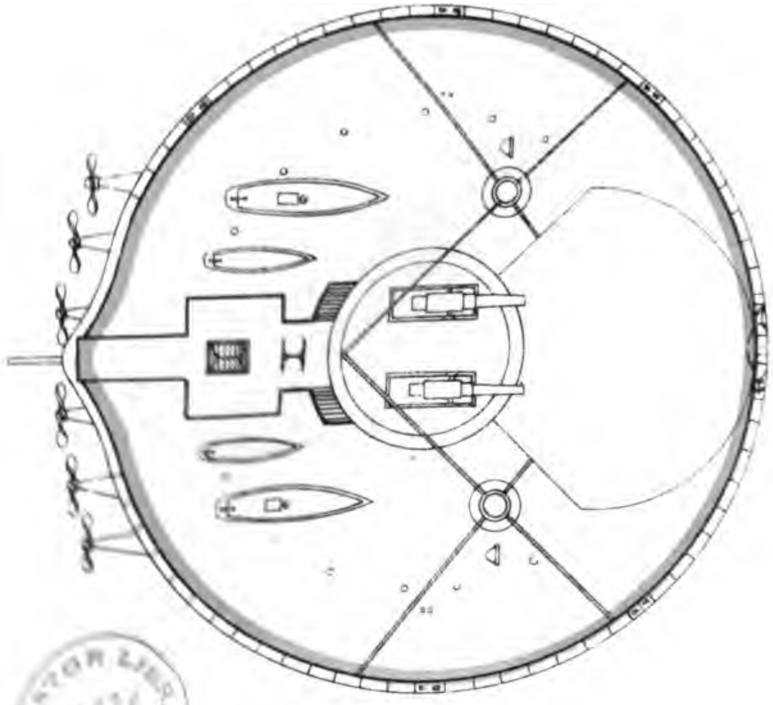
Pl 122.

RUSSIAN SHIPS.

Deck of "Novgorod"



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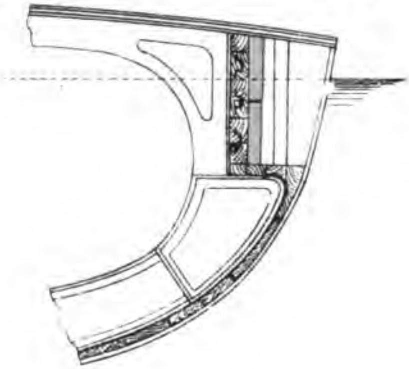
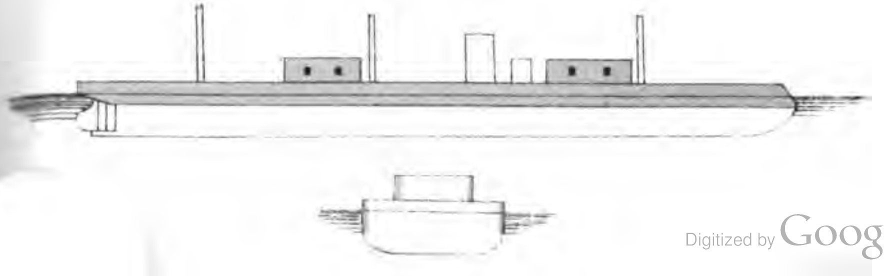
Side Armour of the "Vice Admiral Popoff."

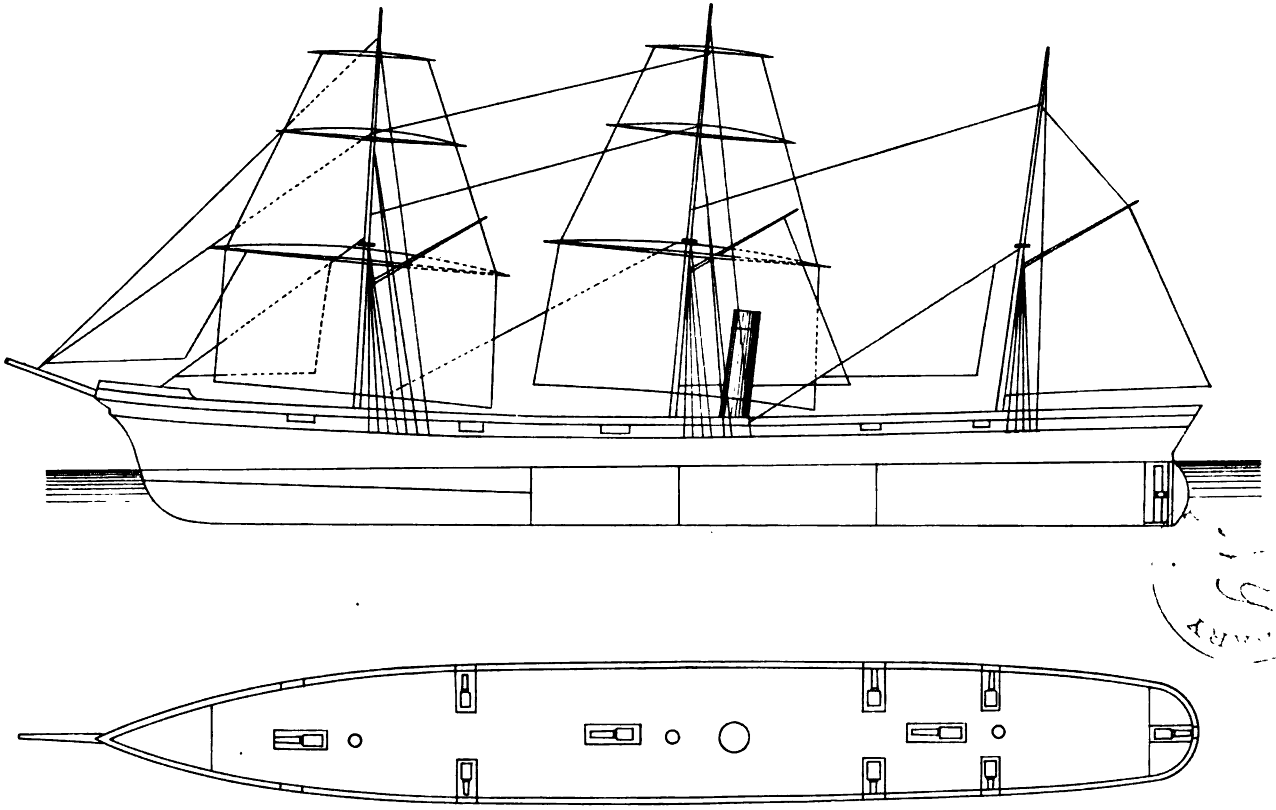


"Smertz"



RUSSIAN SHIPS.

"Asia".



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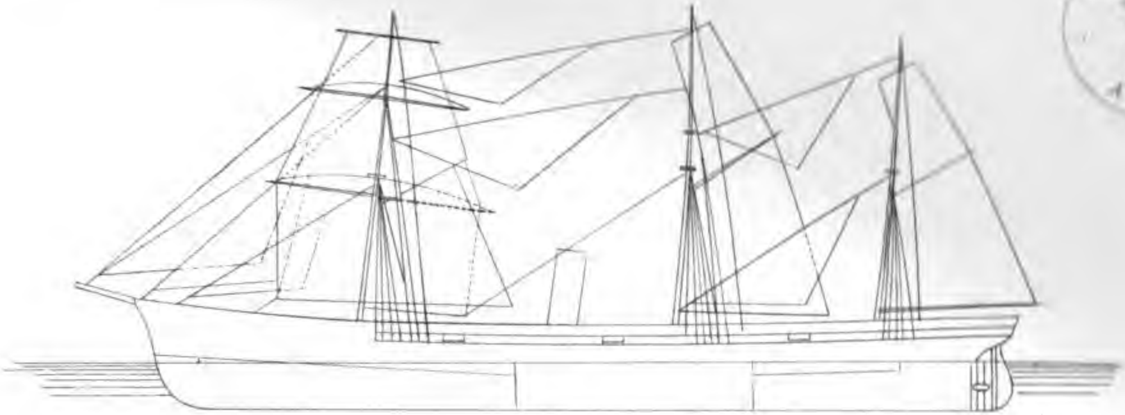
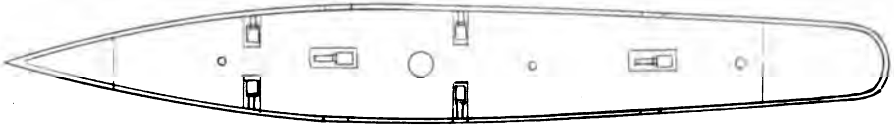
HANHART, LITH.

RUSSIAN SHIPS.

"Zabiyaka"

THE ASTOR LIBRARY NY





HANHART LITH.

Pl. 125.

RUSSIAN TORPEDO BOAT.

"Wiborg"

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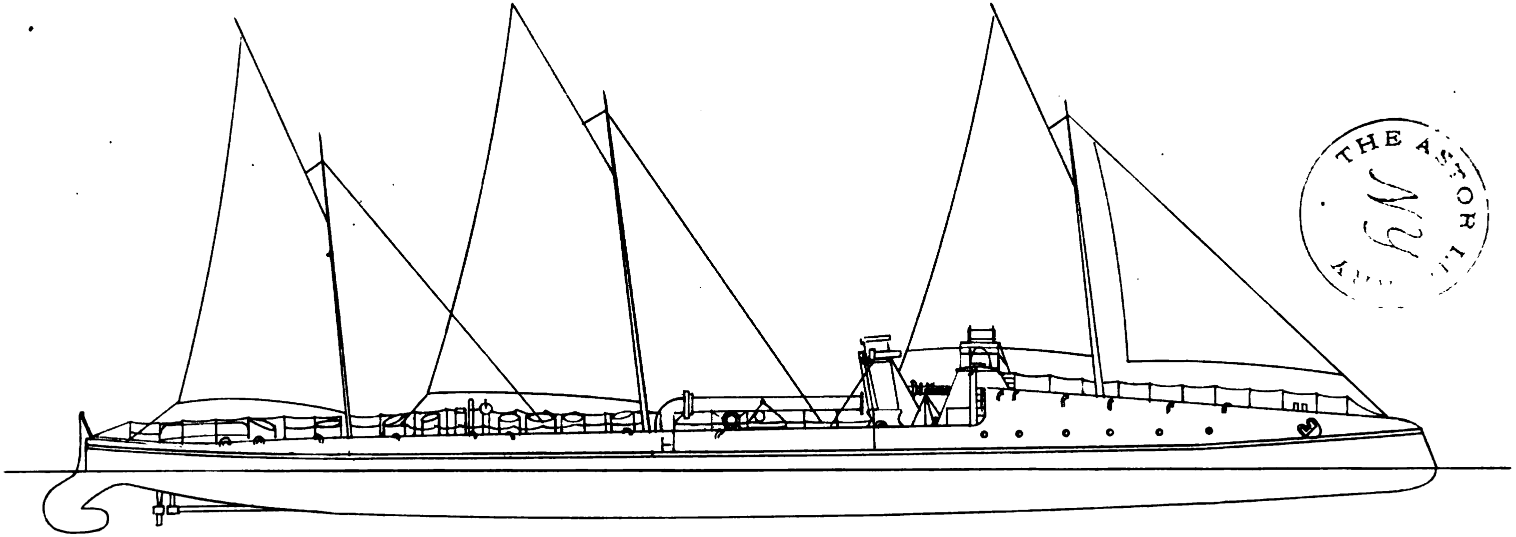


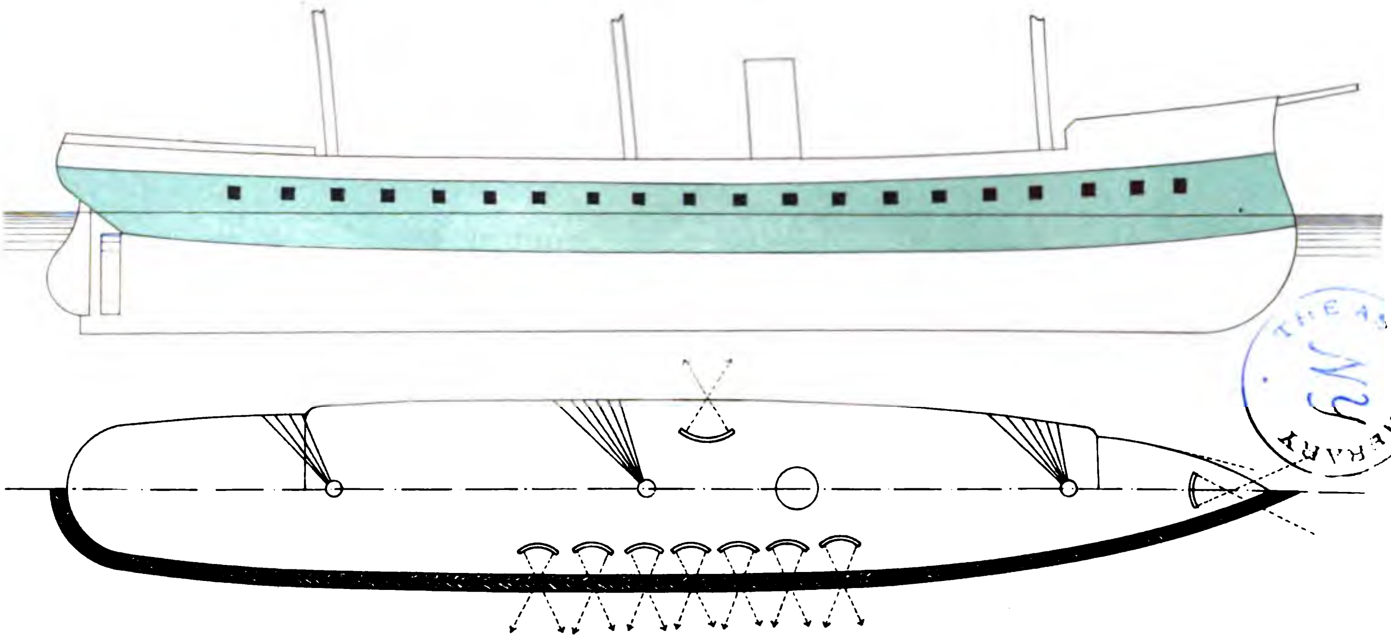
Special Scale.

HANHART LITH

Pl. 126.

SPANISH SHIPS.

"Numancia."



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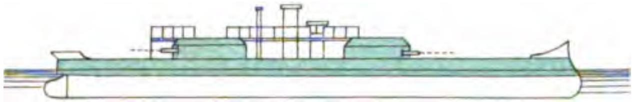
"Puig-cerda."

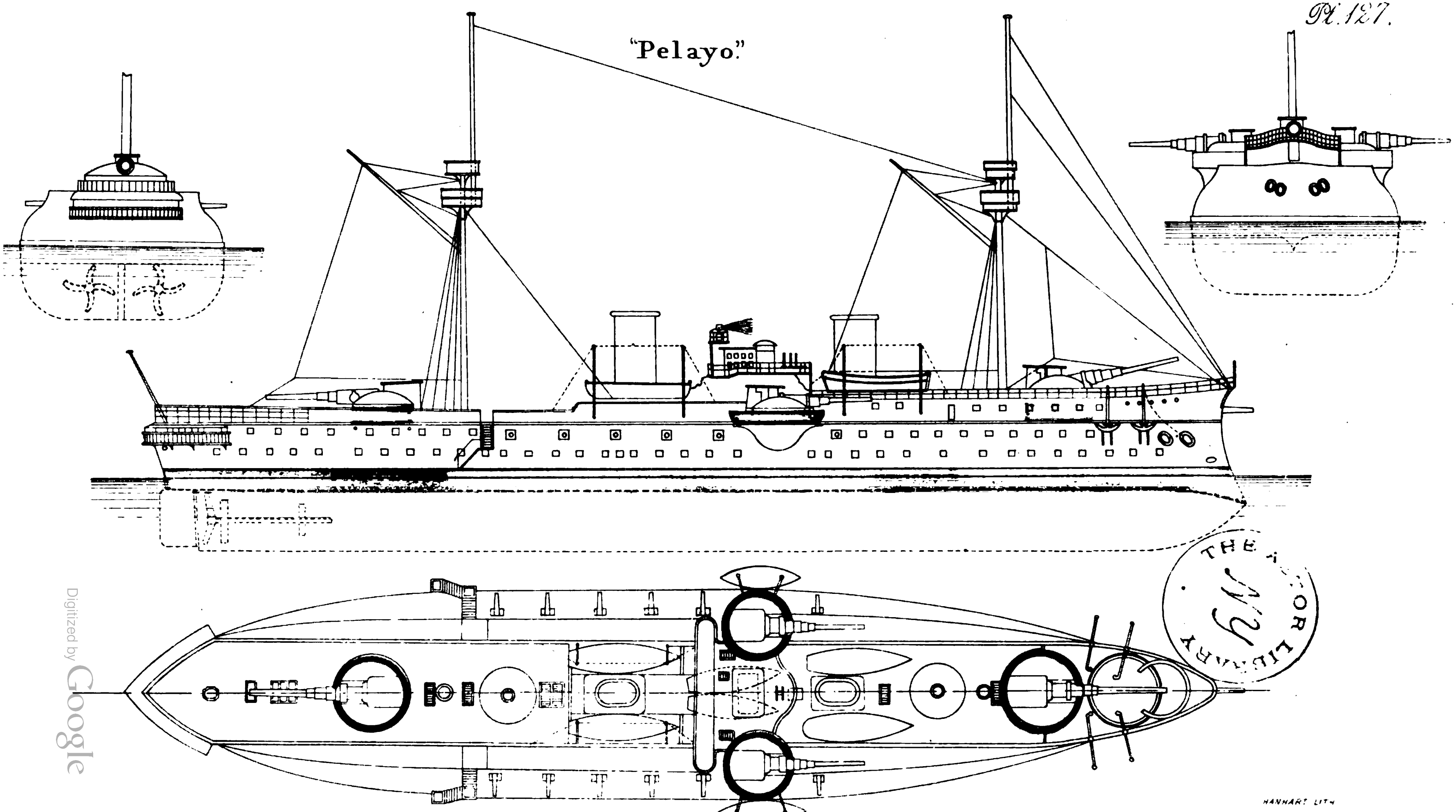


HANHART, LITH

SPANISH SHIPS.

Pl. 127.

"Pelayo."



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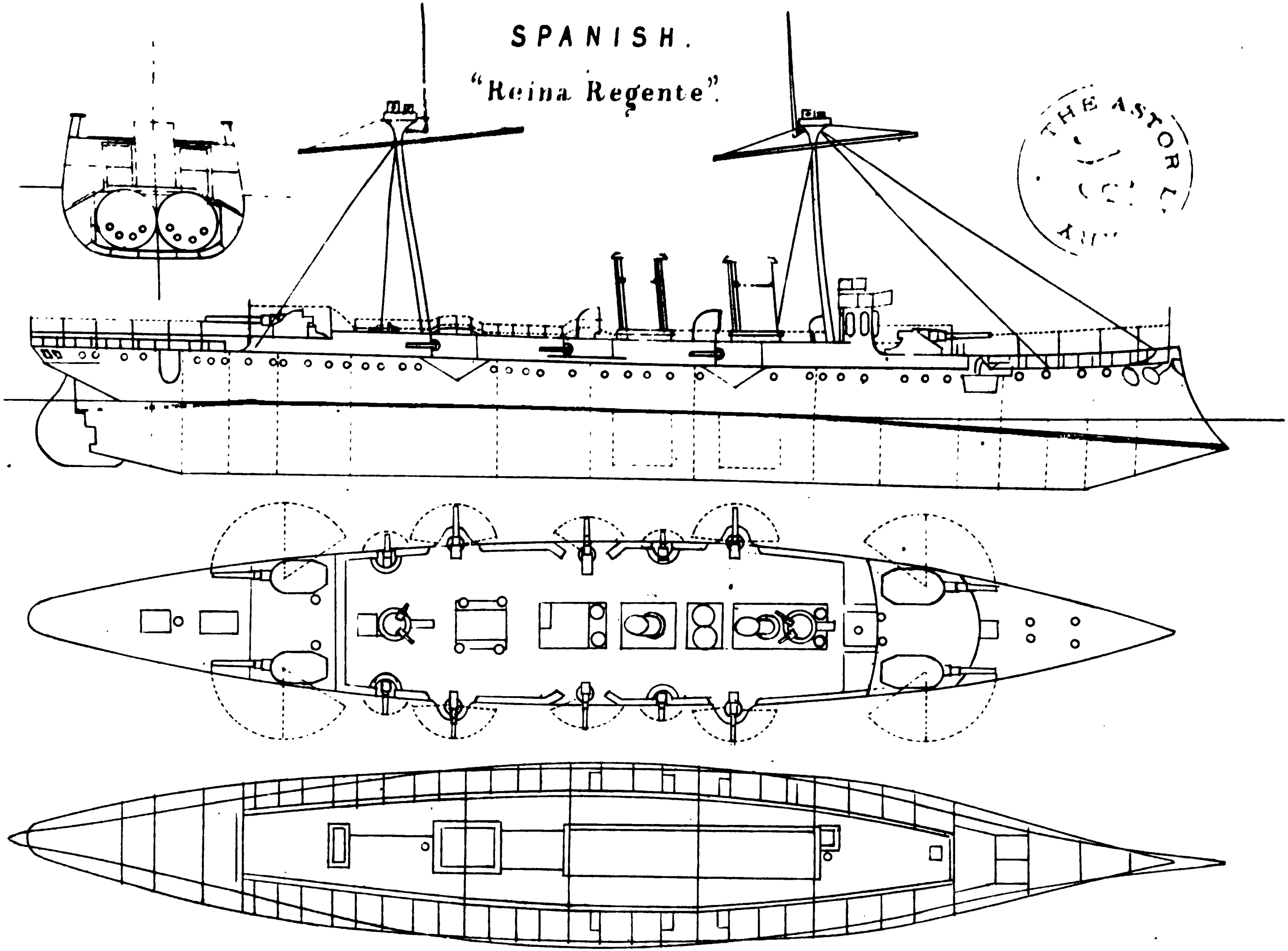
HANHART LITH

Pl. 128.

SPANISH.

"Reina Regente".

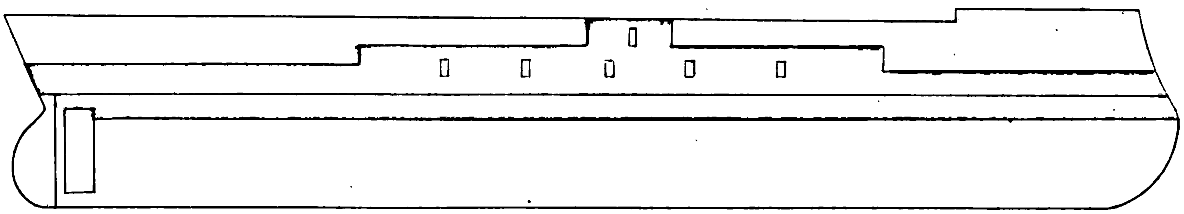
THE ASTOR L... ...RY

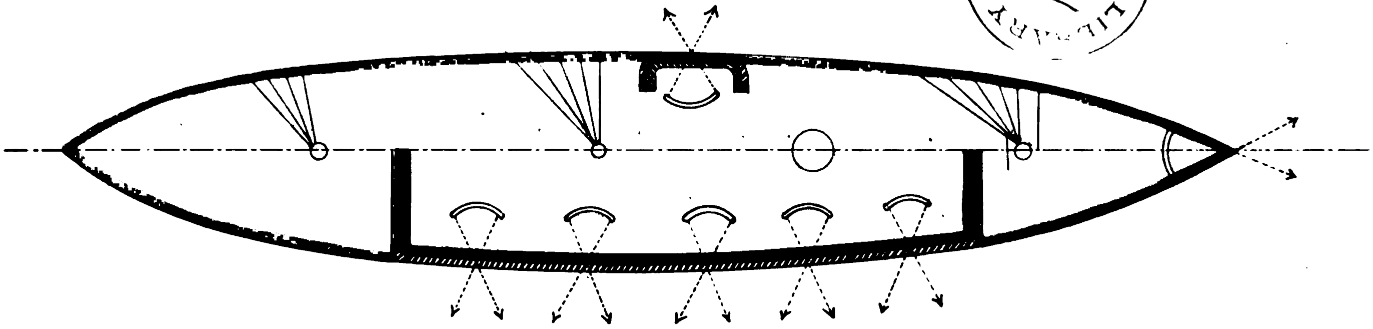


HANHART LITH.

SPANISH.

"Sagunta".





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HANHART LITH

№ 120.

RUSSIAN SHIPS

"Minin"

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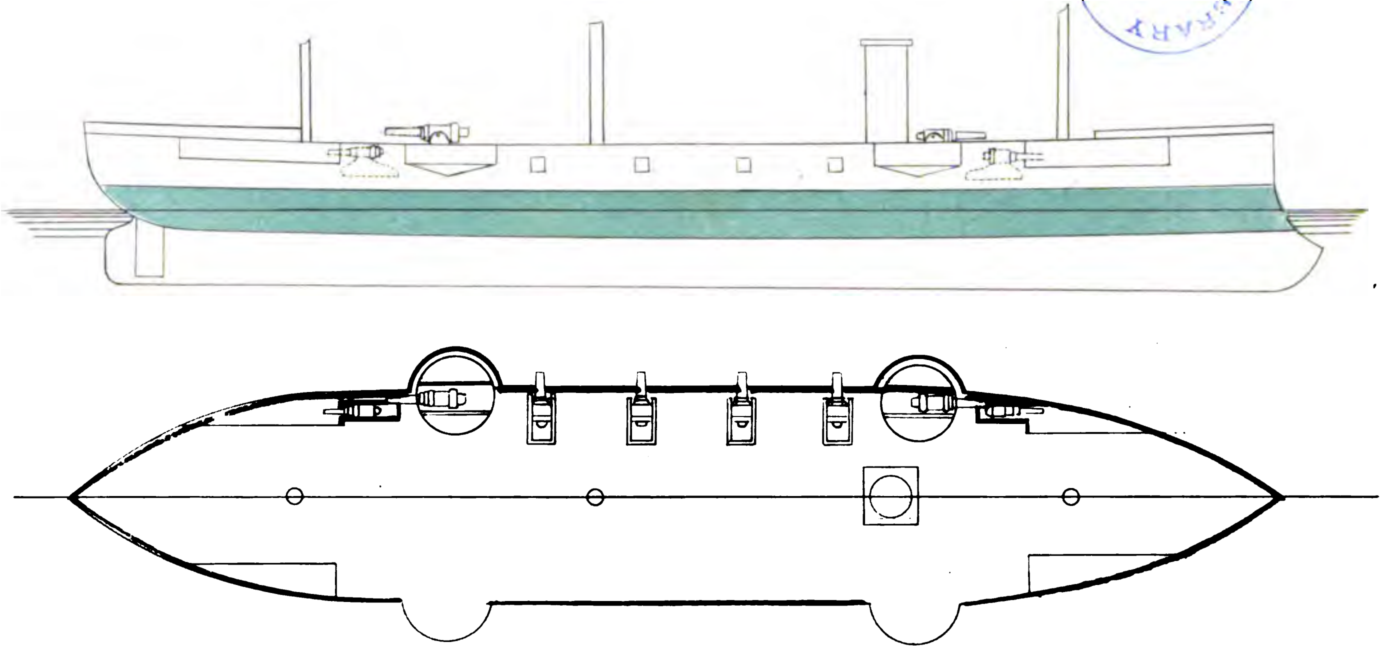
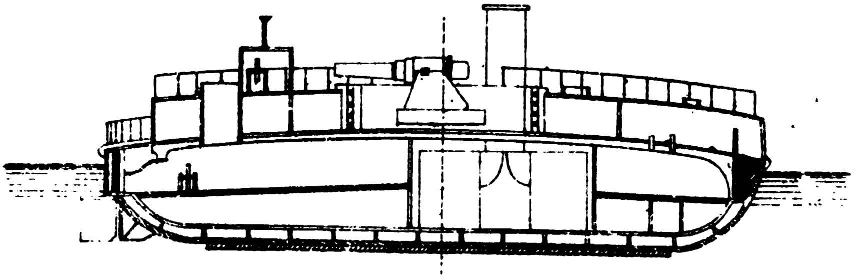


HANHART LITH

Pl. 121.

"Novgorod", Section.



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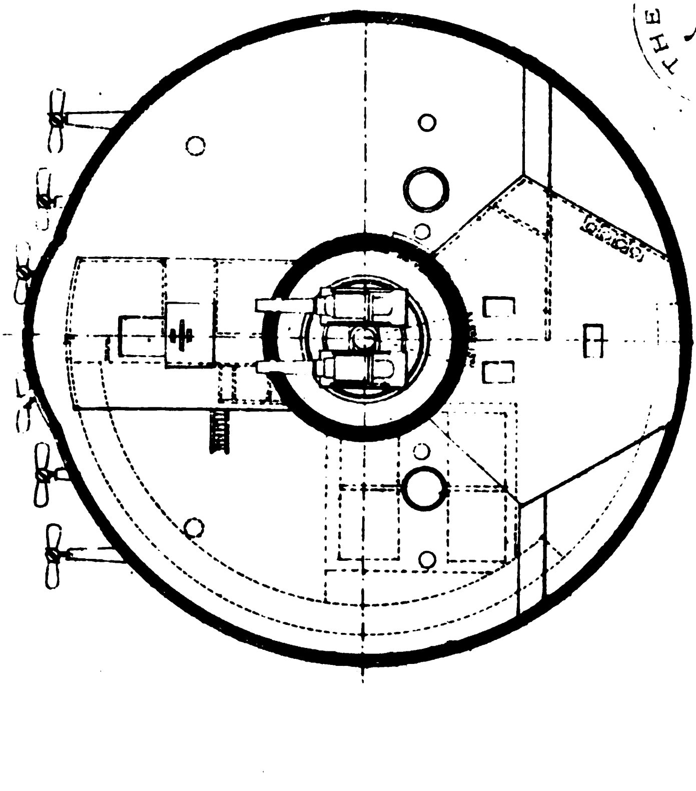

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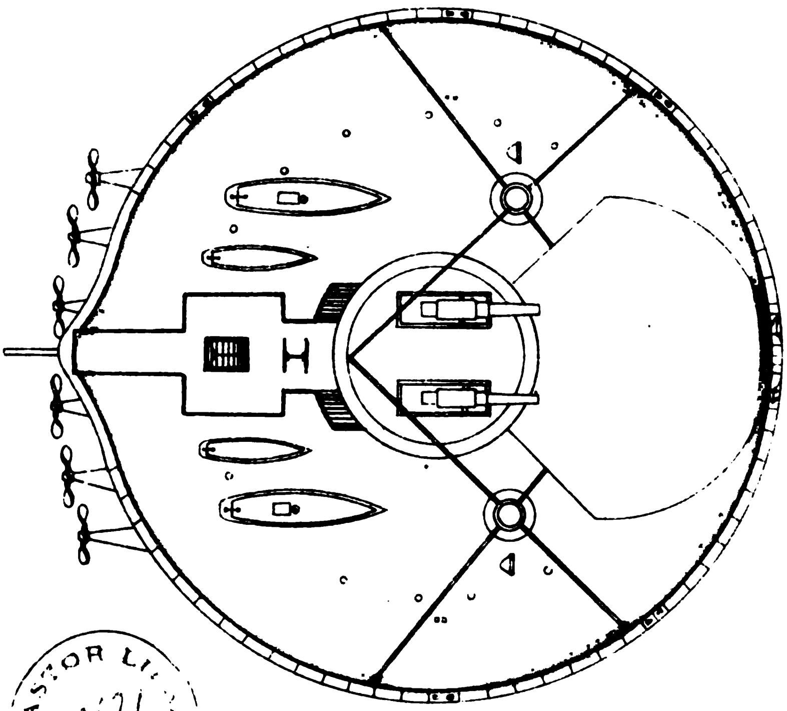
RUSSIAN SHIPS.

Deck of "Novgorod"



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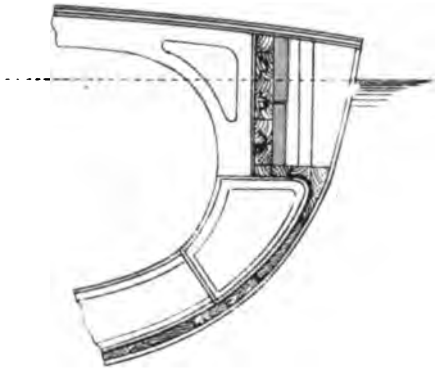
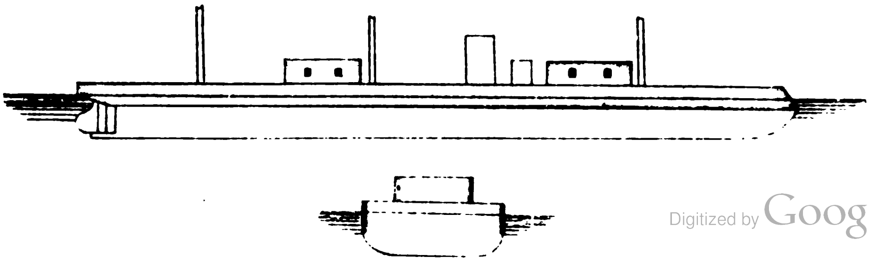
Side Armour of the "Vice Admiral Popoff."



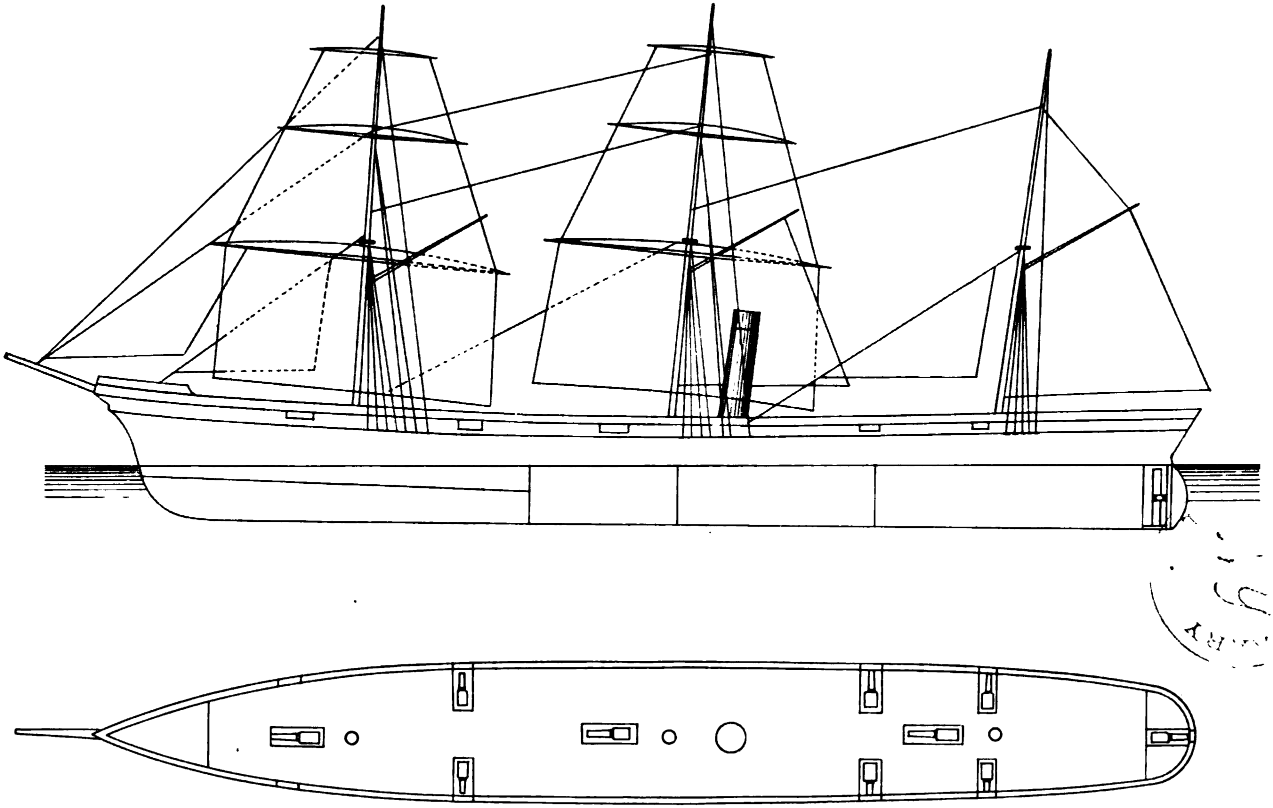
"Smertz"



RUSSIAN SHIPS.

Pl. 123.

"Asia".



HANHART, LITH.

Pl. 124.

RUSSIAN SHIPS.

"Zabiyaka"

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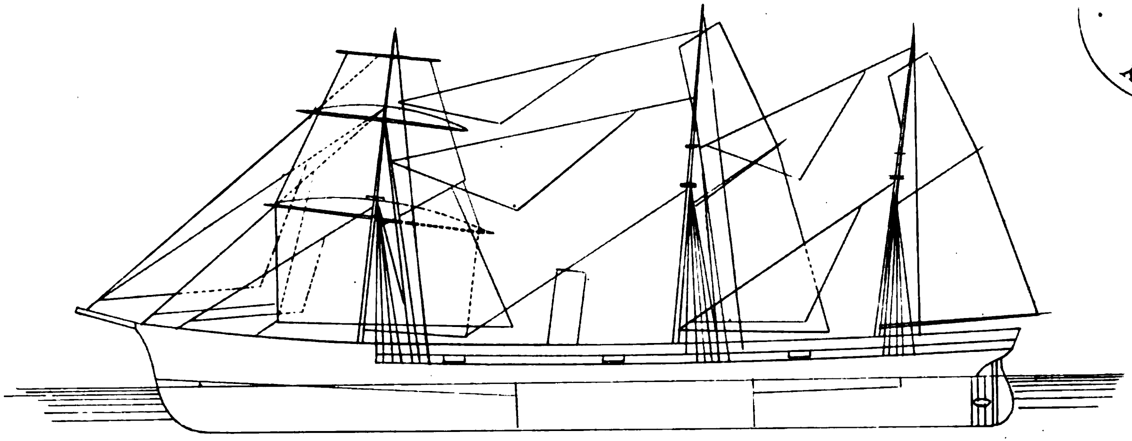
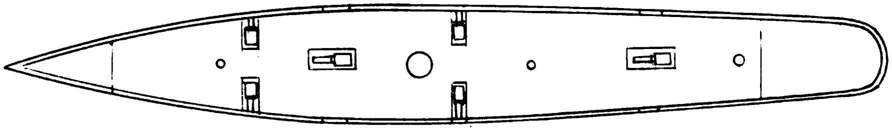
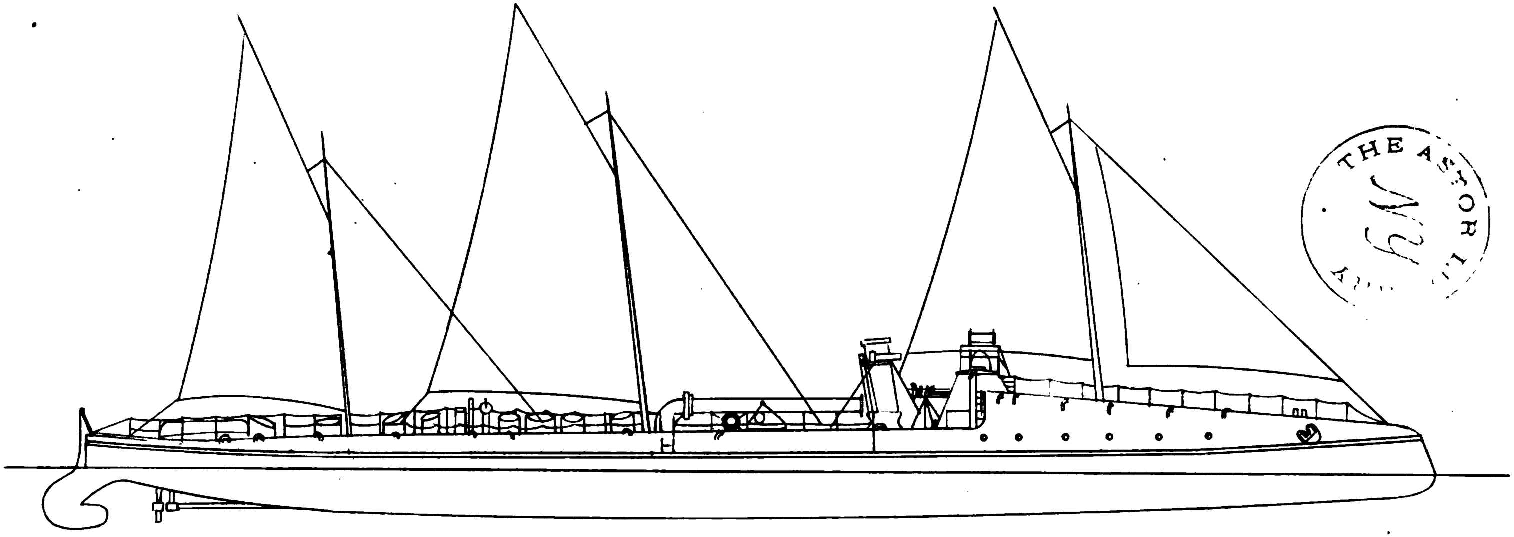




HANHART LITH.

RUSSIAN TORPEDO BOAT.

"Wiborg"



Special Scale.

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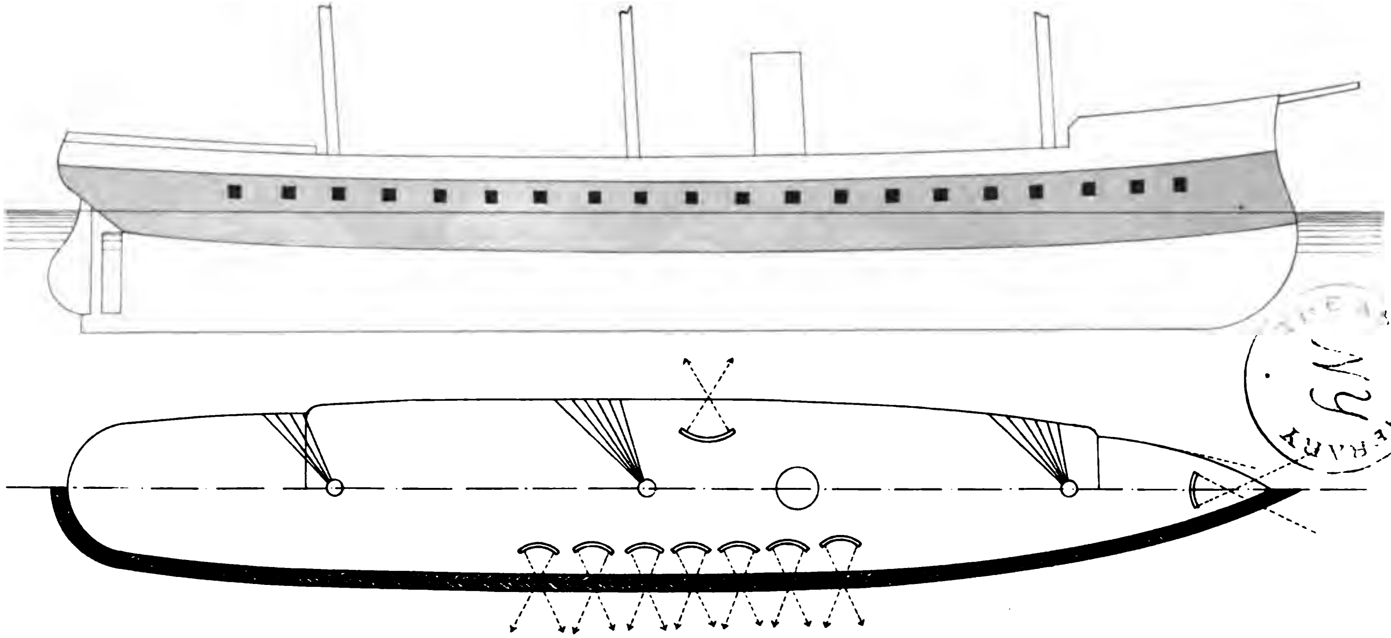
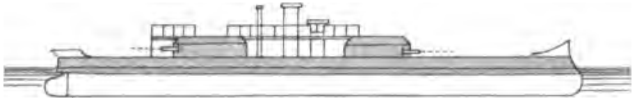
HANNHART LITH

SPANISH SHIPS.

"Numancia."



"Puig-cerda."



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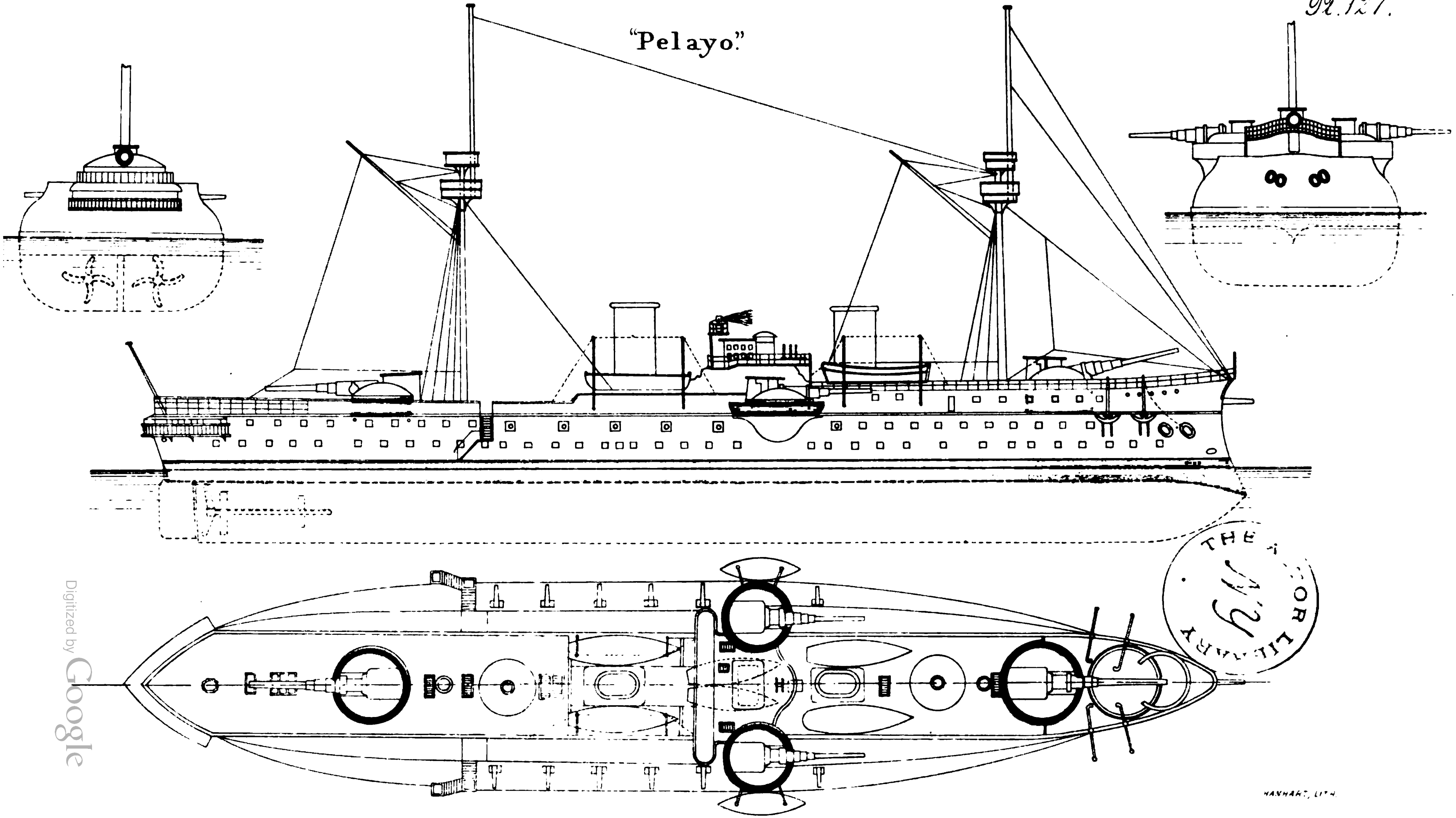
HANHART, LITH

SPANISH SHIPS.

Pl. 127.

"Pelayo."



HANHART, LITH.

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Pl. 128.

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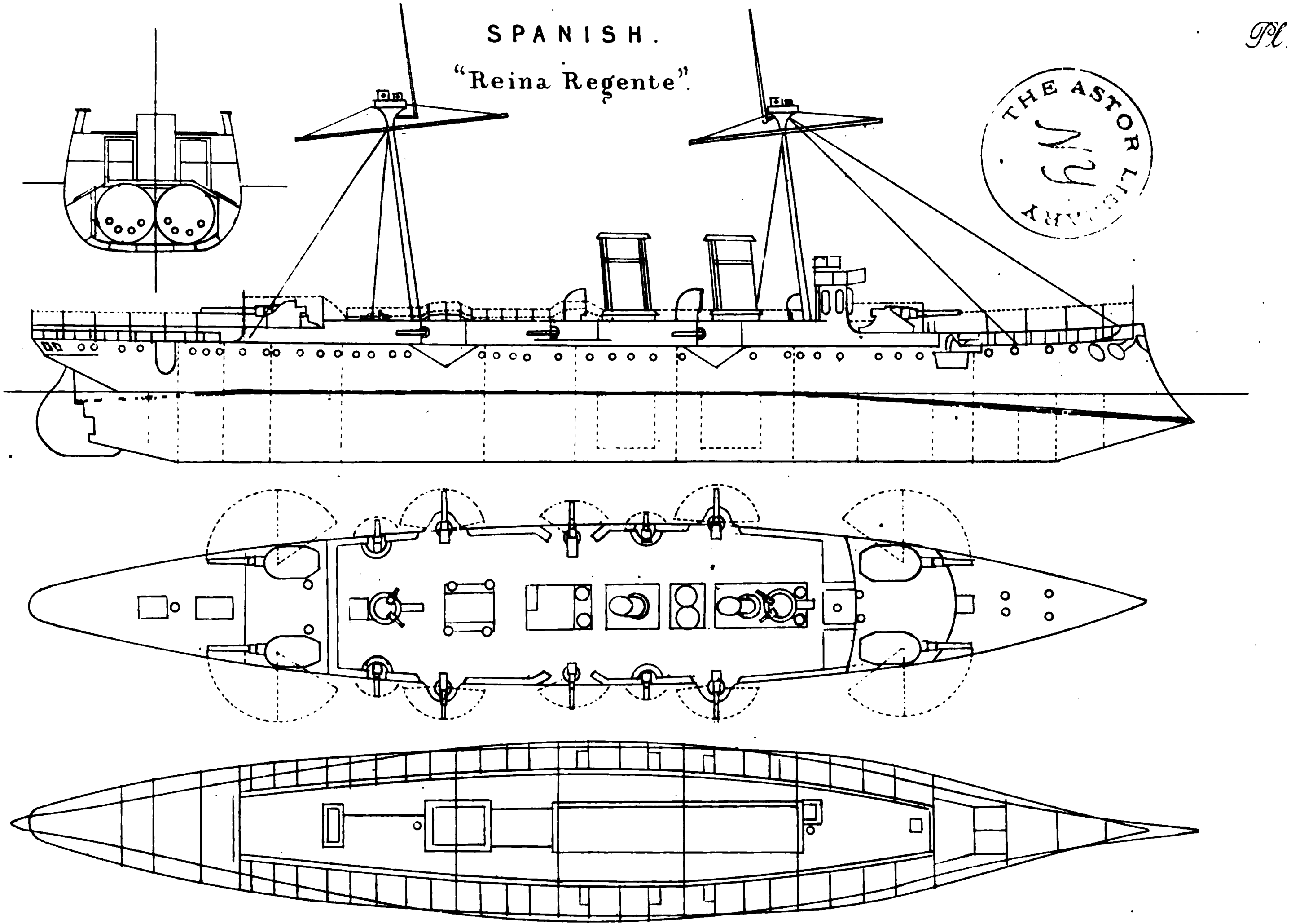
SPANISH.

"Reina Regente".

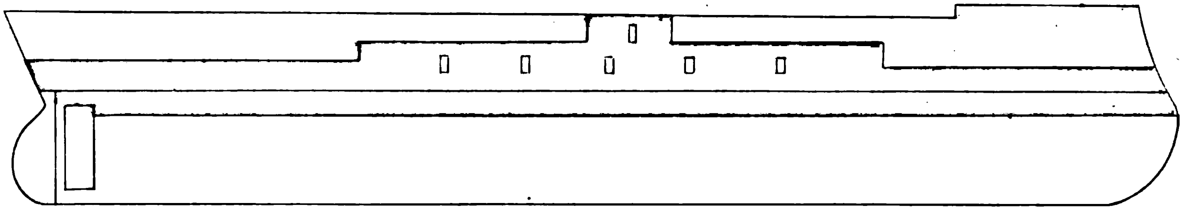


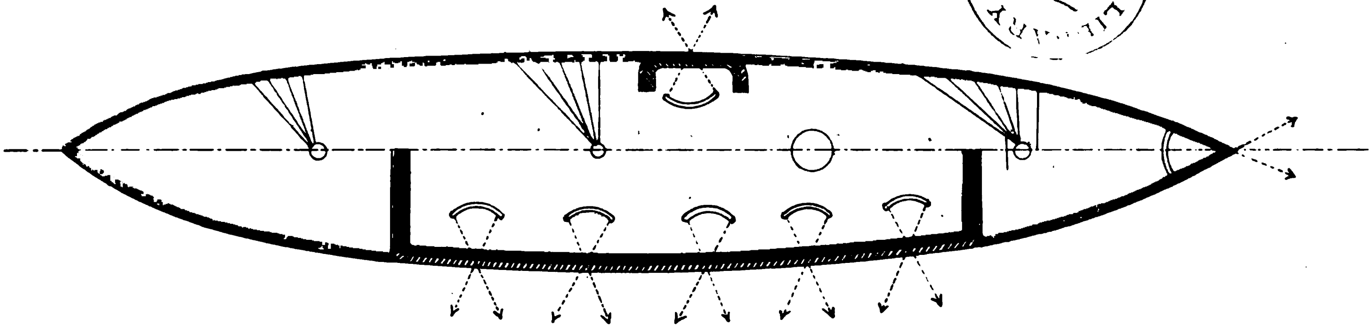
HANHART LITH.

Pl. 129

SPANISH.

"Sagunta".





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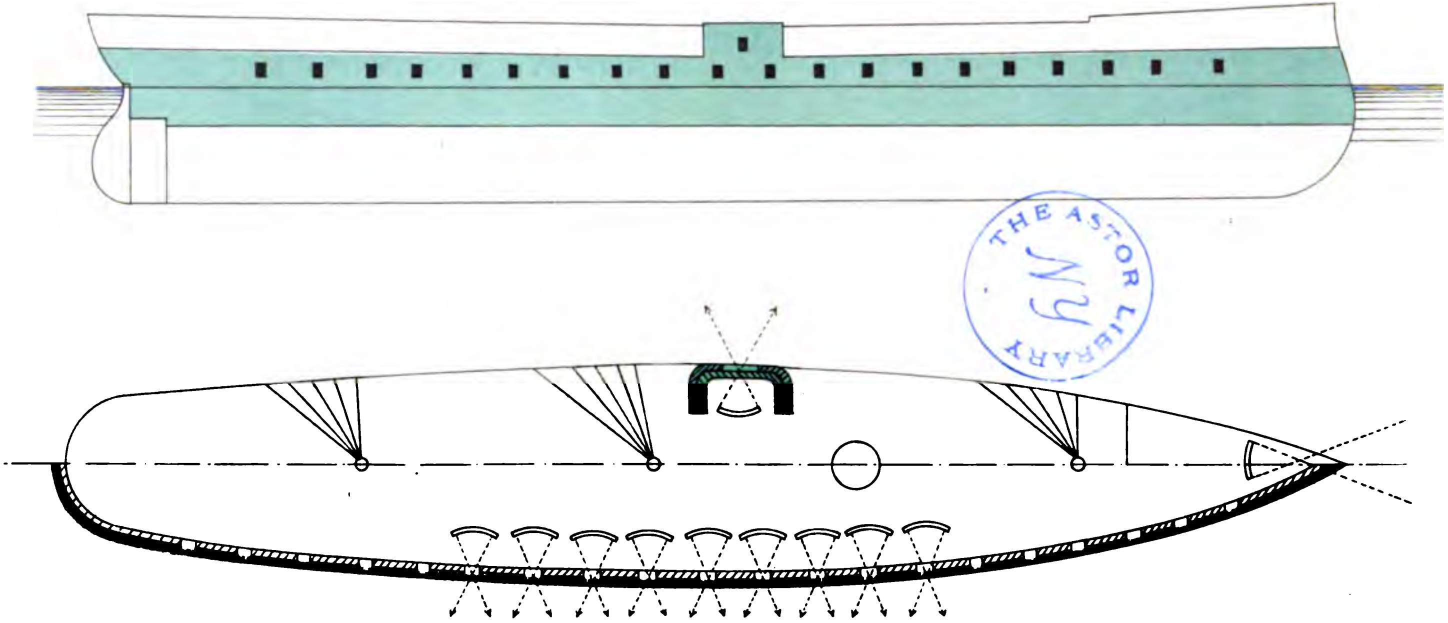
HANHART LITH.

SPANISH SHIPS.

"Vitoria."



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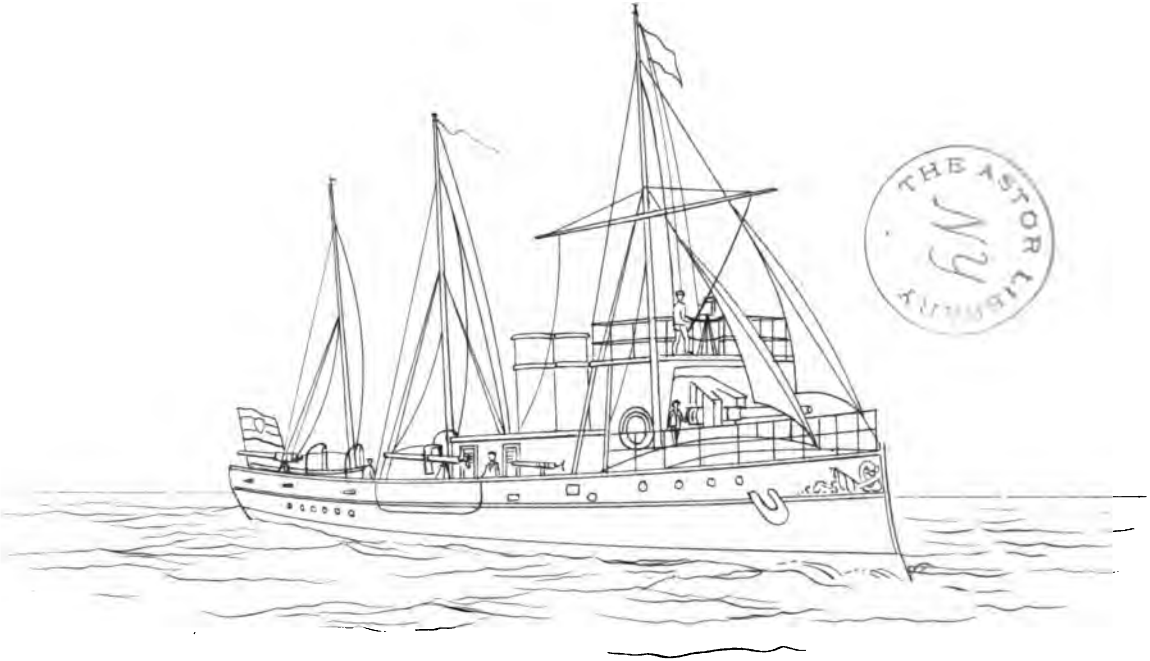
MANHART, LITH.

X.129a.

El Destructor.
(Torpedo Cruiser)



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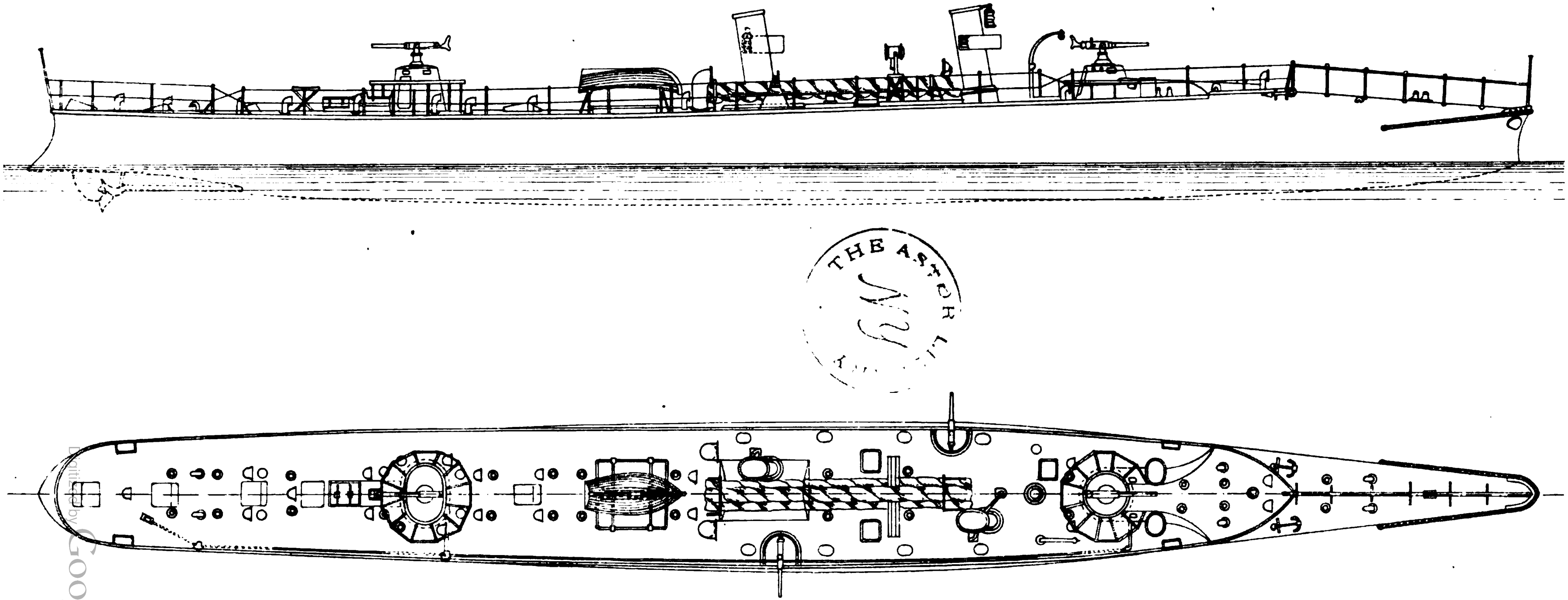
"Ariete". Thorneycrofts, Torpedo Boat.

On Special Scale.



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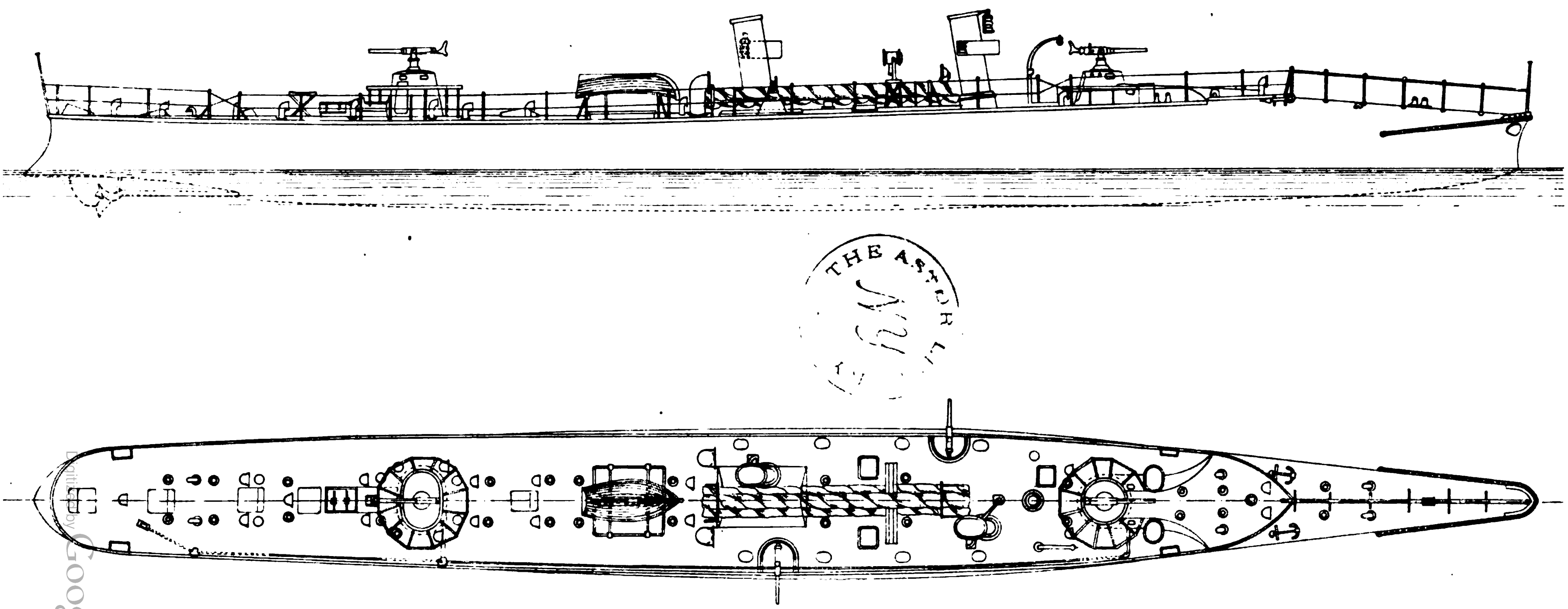
SPANISH SHIPS.

"Ariete". Thorneycrofts, Torpedo Boat.

On Special Scale



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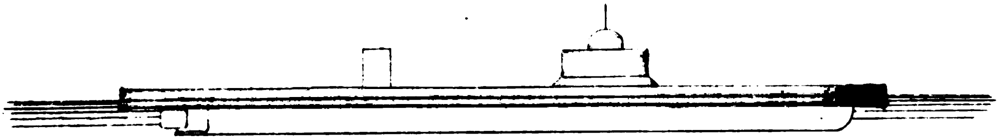
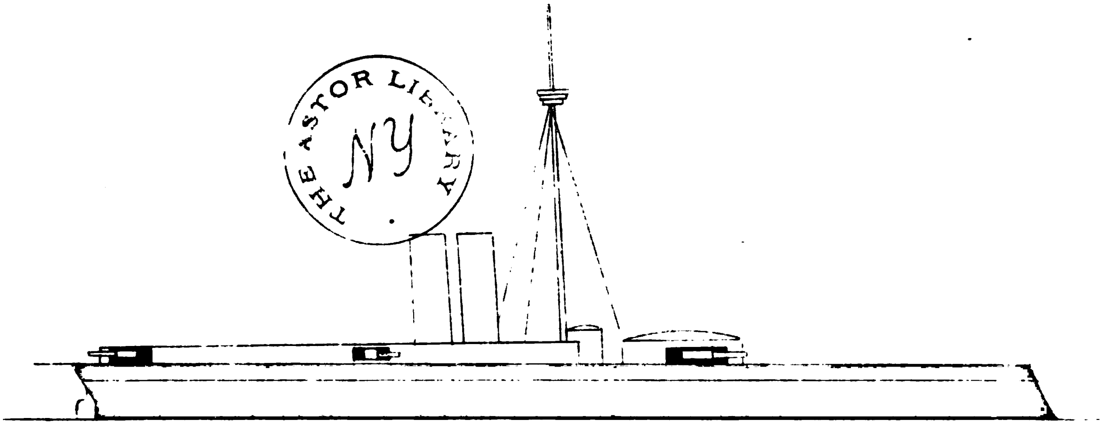
SWEDISH SHIPS.

"John Ericsson".



"Svea".



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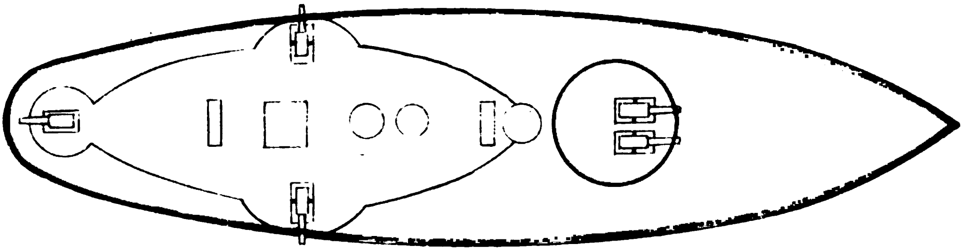
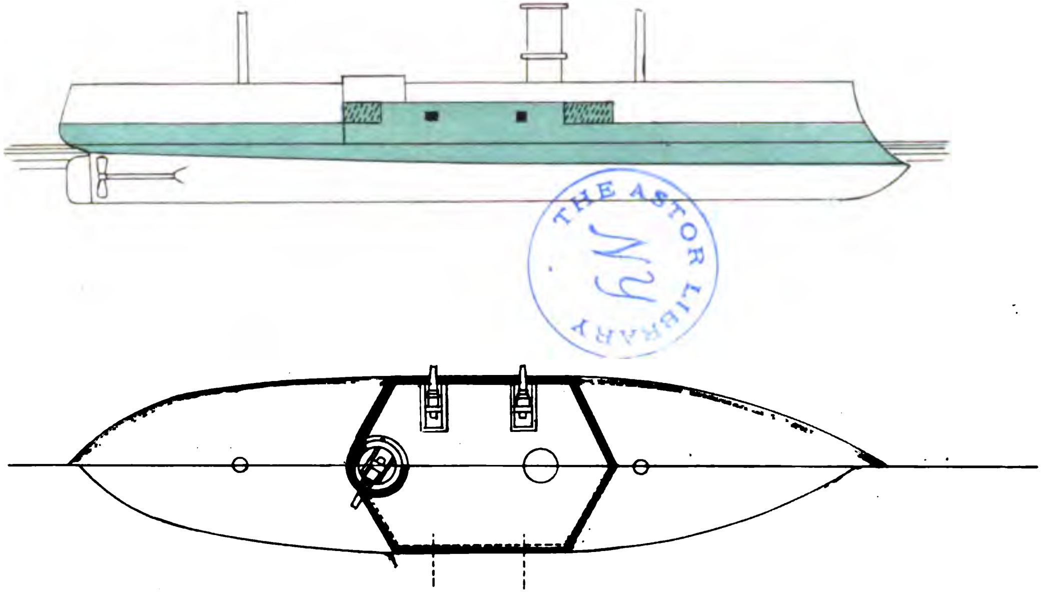


TURKISH.

"Assar-i-Schifket".



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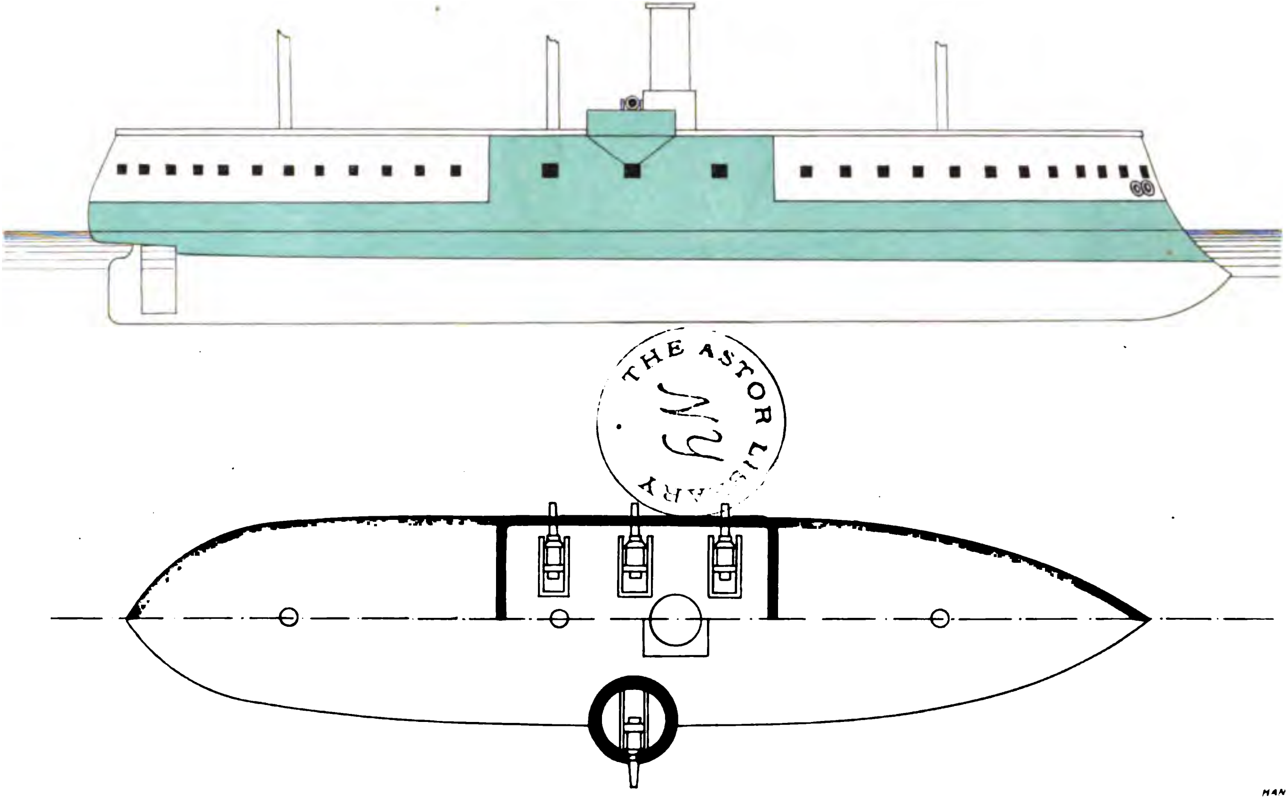
HANHART LITH

TURKISH SHIPS.

"Assar-i-Tevfik."



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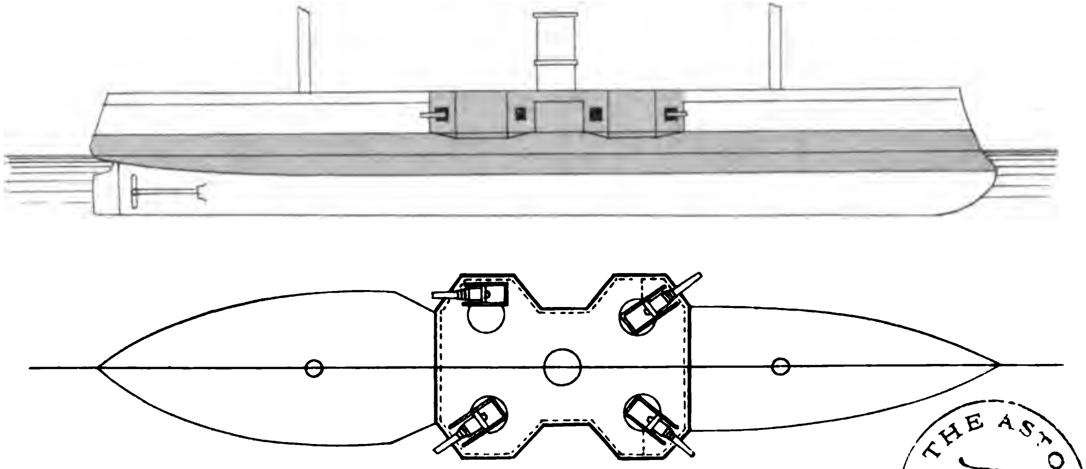
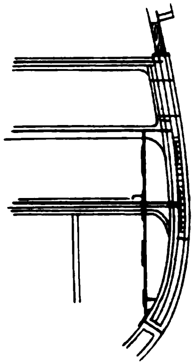
MANHART, LITH.

TURKISH SHIPS.

Avni - Illah.



Azazieh.



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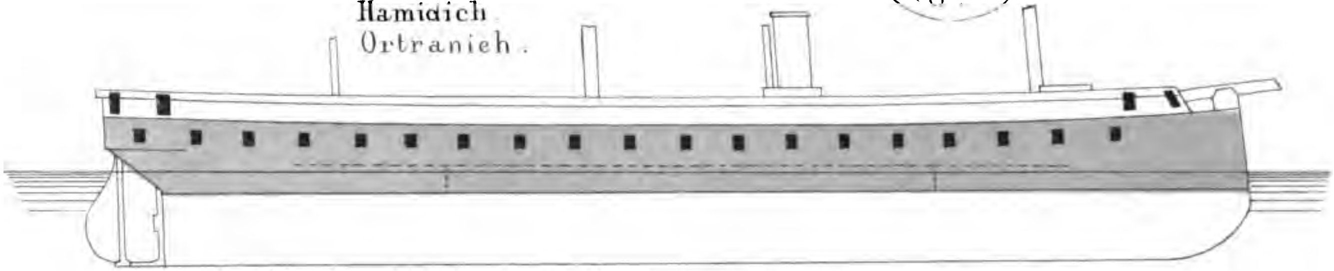
Azazieh.
Hamidieh.
Ortranieh.

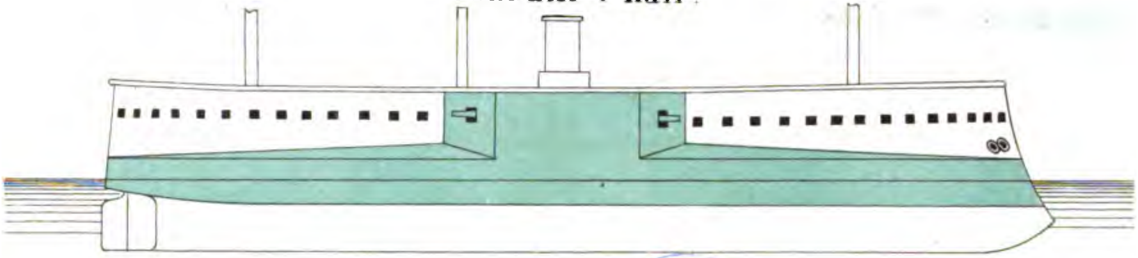


HANHART, LITH

Pl. 136.

TURKISH SHIPS.

"Feth-i-Bulend."
"Mukadin-i-Hair."



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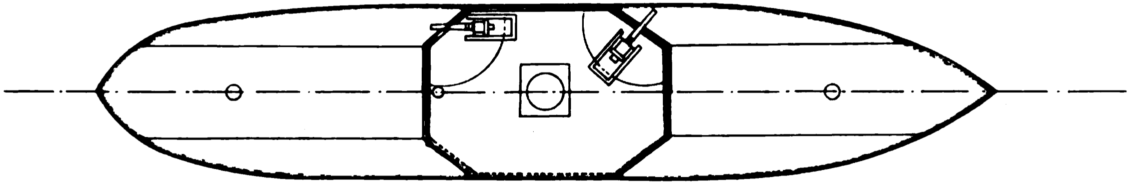
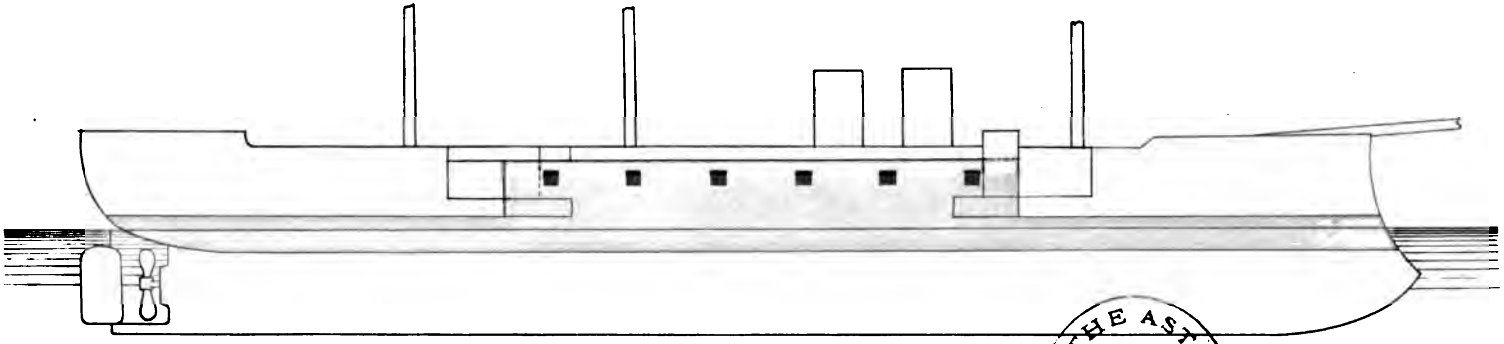


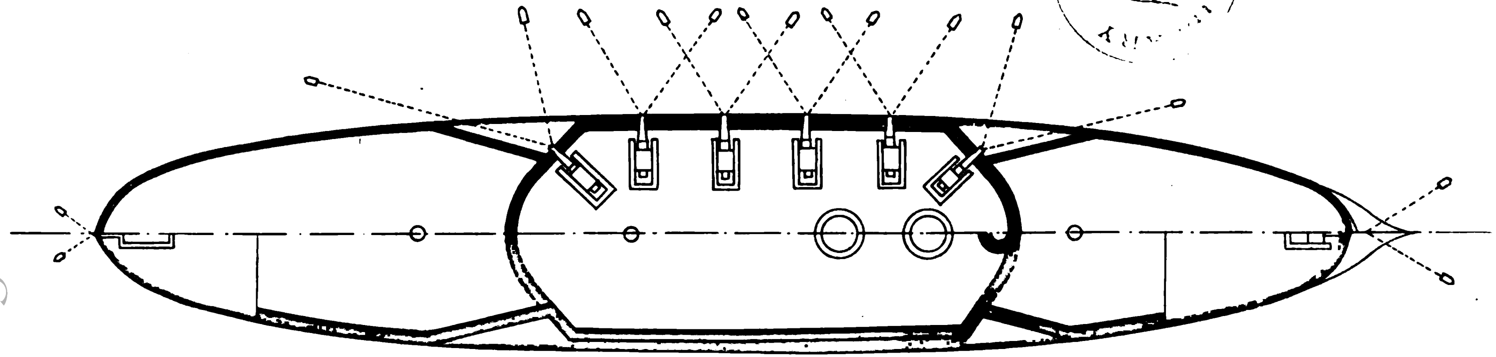
HANHART, LITH

Pl. 137.

TURKISH SHIPS.

"Mesoodieh."





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HANHART, LITH.

TURKISH SHIPS.

Submarine Boat "Nordenfelt."

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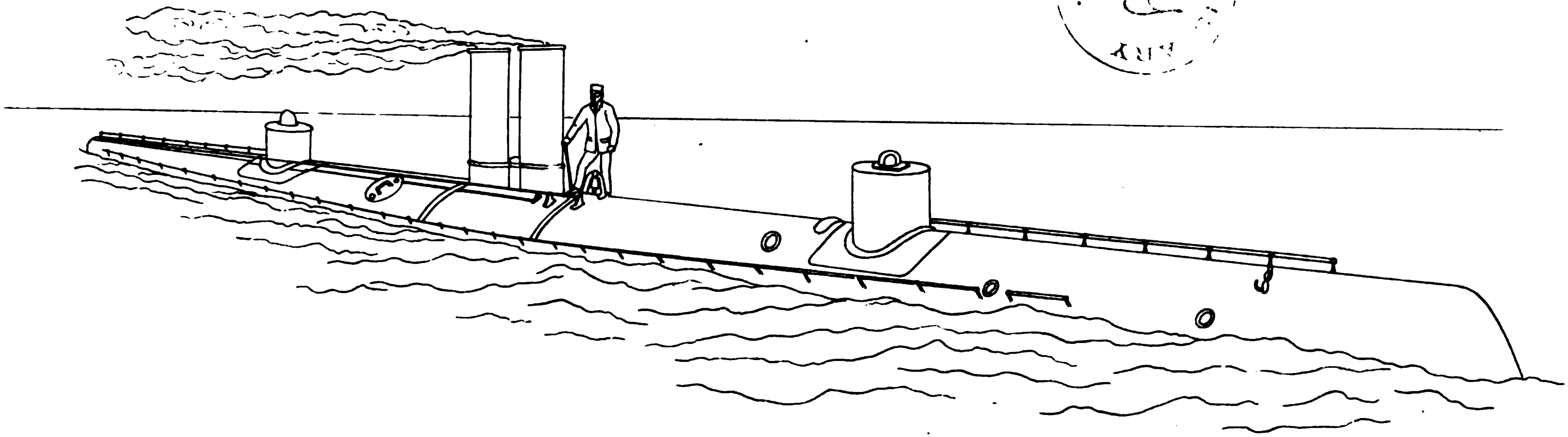

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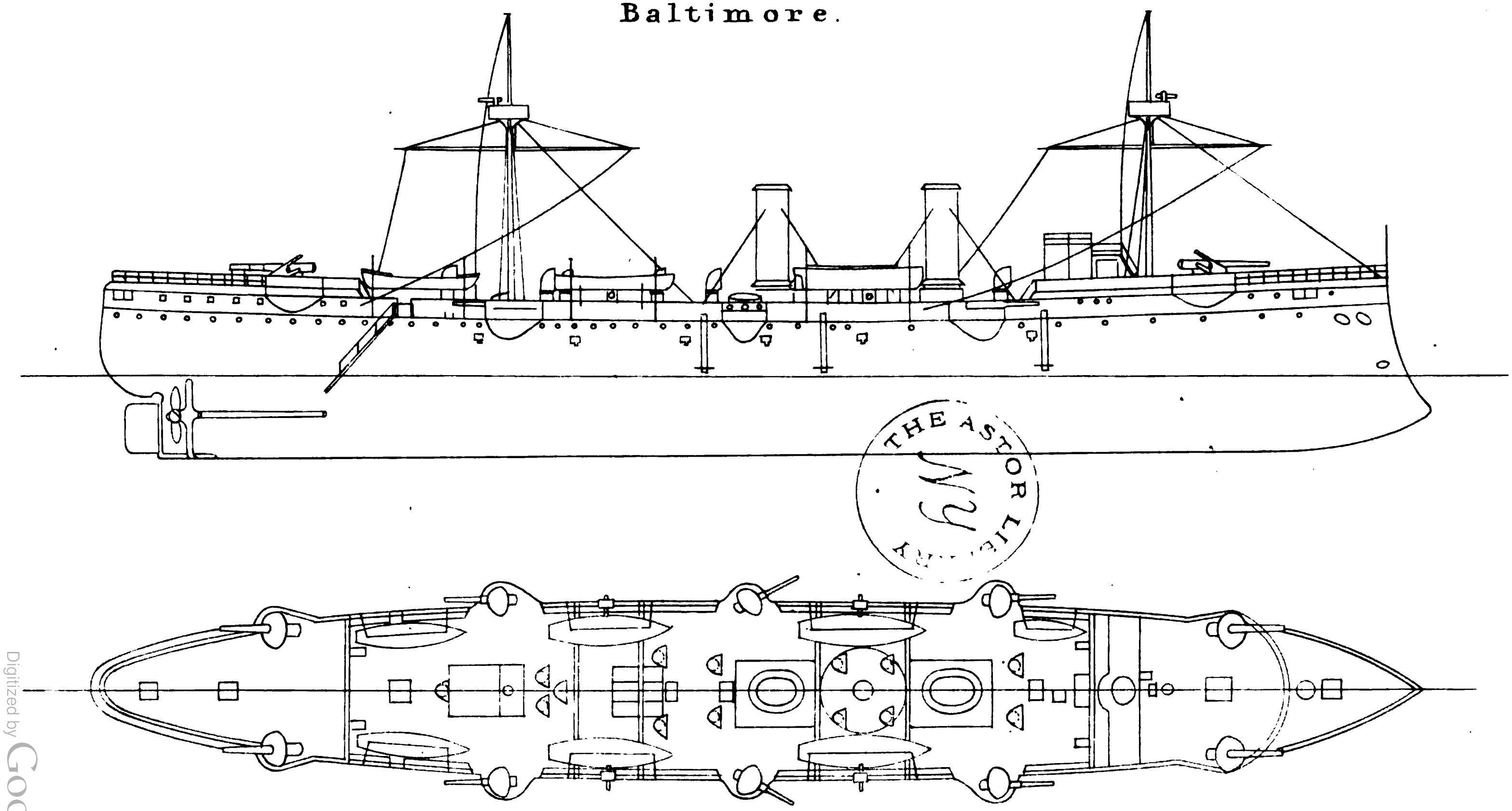
AMERICA-UNITED STATES SHIPS.

Baltimore.



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Pl. 139a.

AMERICA-UNITED STATES-SHIPS

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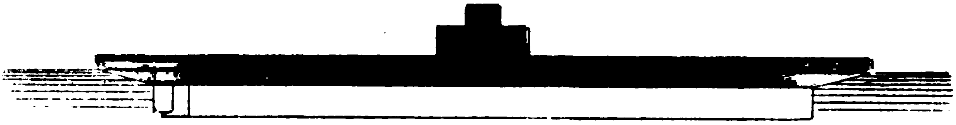

"Camanche."

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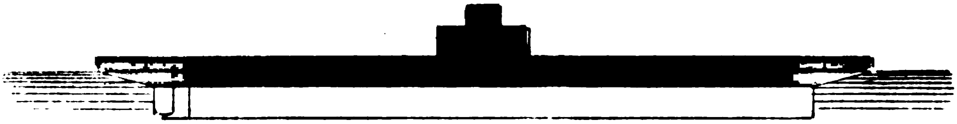
Pl. 139a.

AMERICA-UNITED STATES-SHIPS

"Camanche."



Pl. 140

AMERICA–UNITED STATES SHIPS.

"Atlanta" & "Boston."

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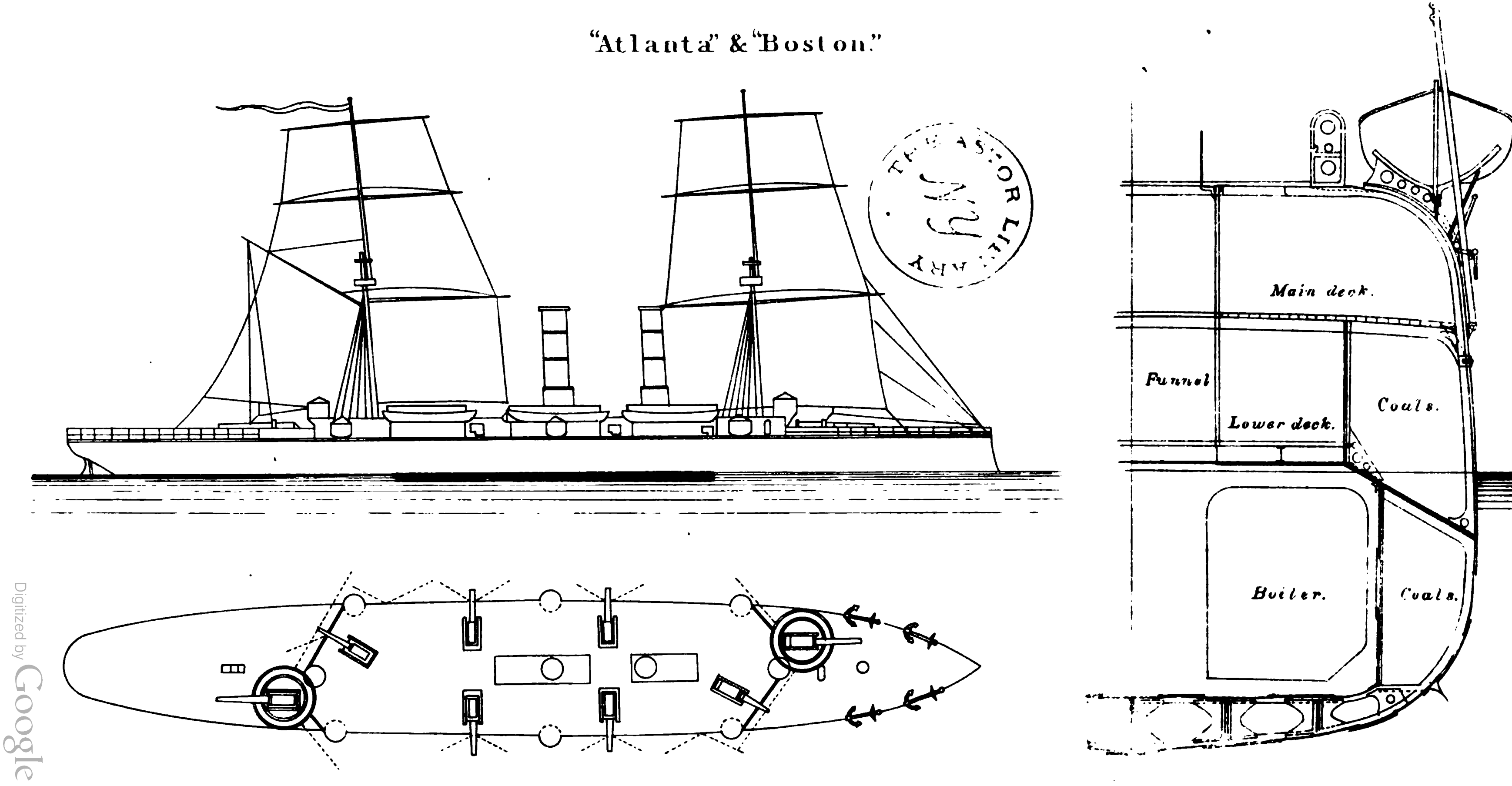

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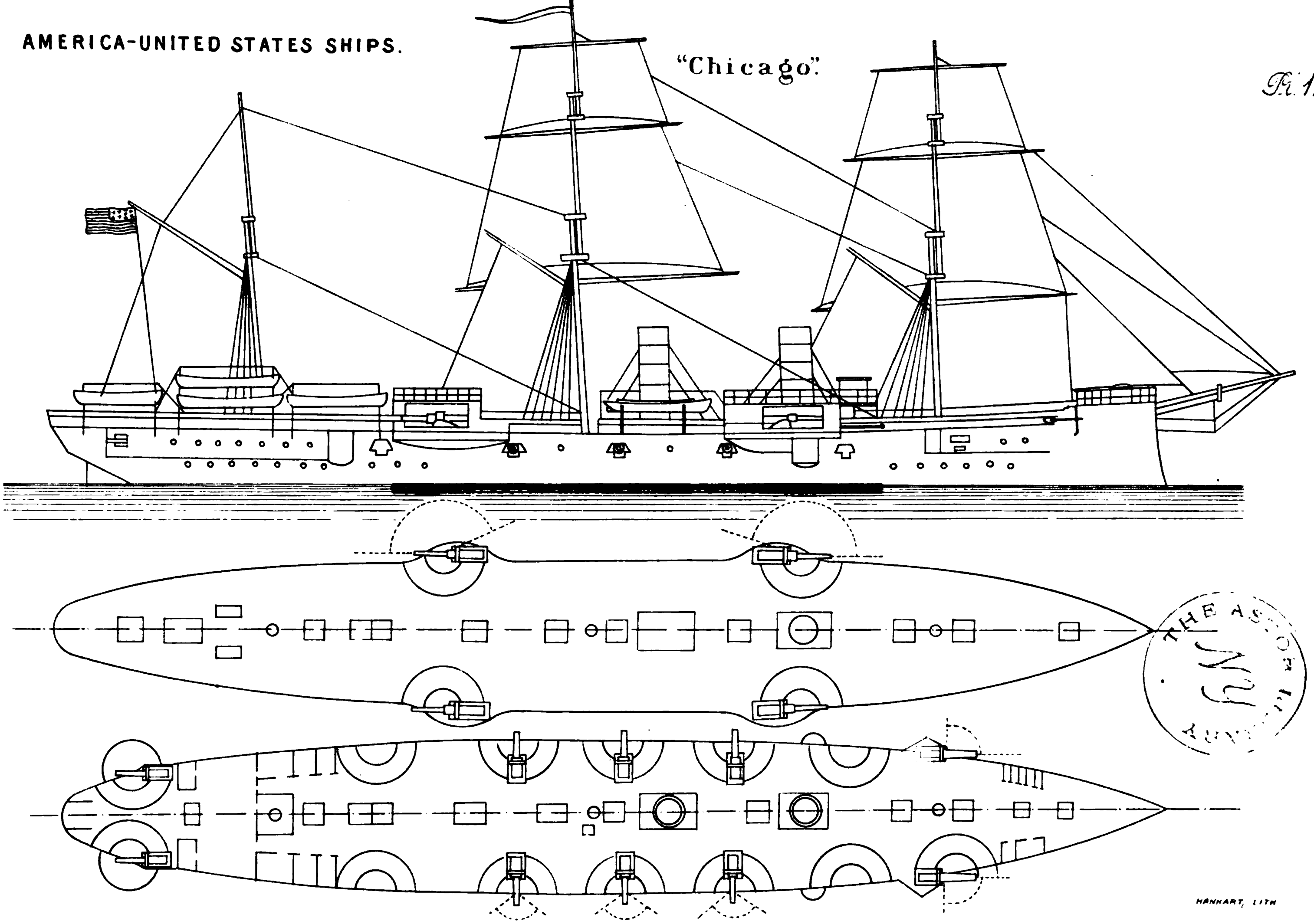
AMERICA-UNITED STATES SHIPS.

Pl. 141.

"Chicago".



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AMERICA-UNITED STATES-SHIPS.

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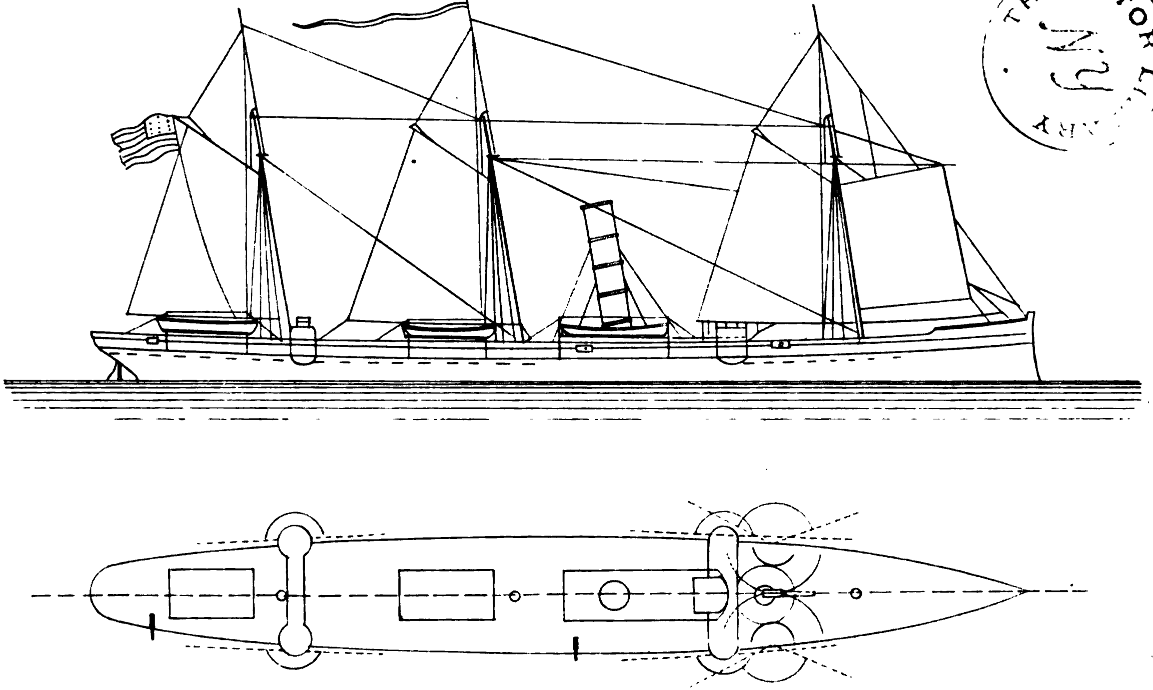
Dolphin.



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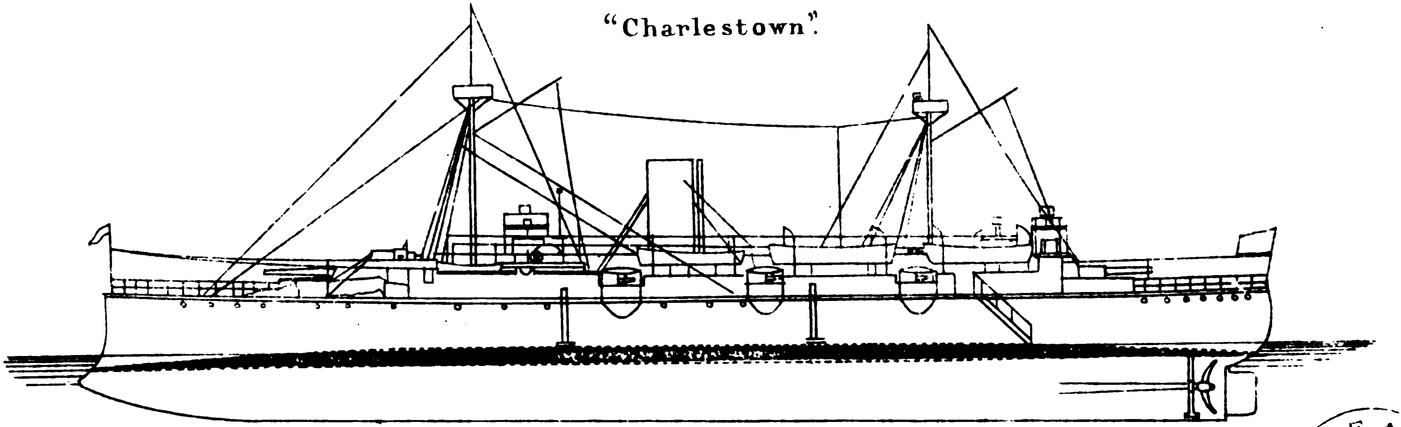
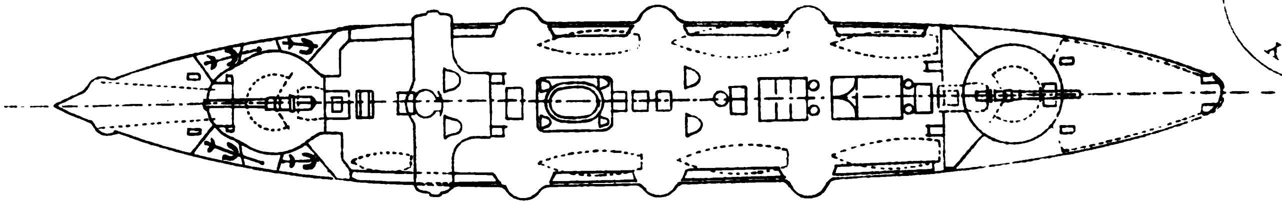
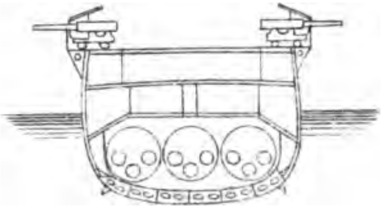
AMERICAN-UNITED STATES-SHIPS.

Pl. 143.

“Charlestown”.







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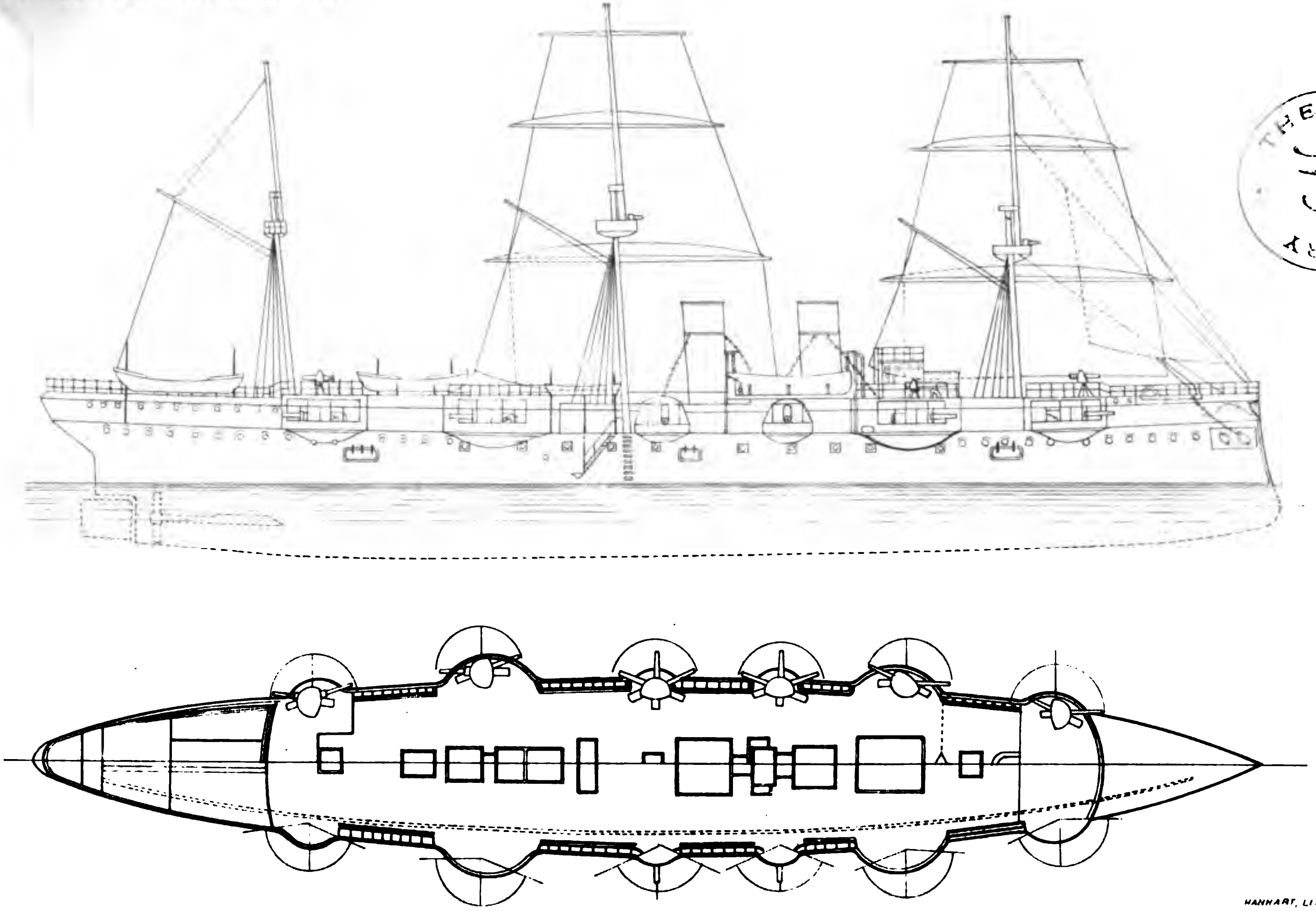
"Newark"

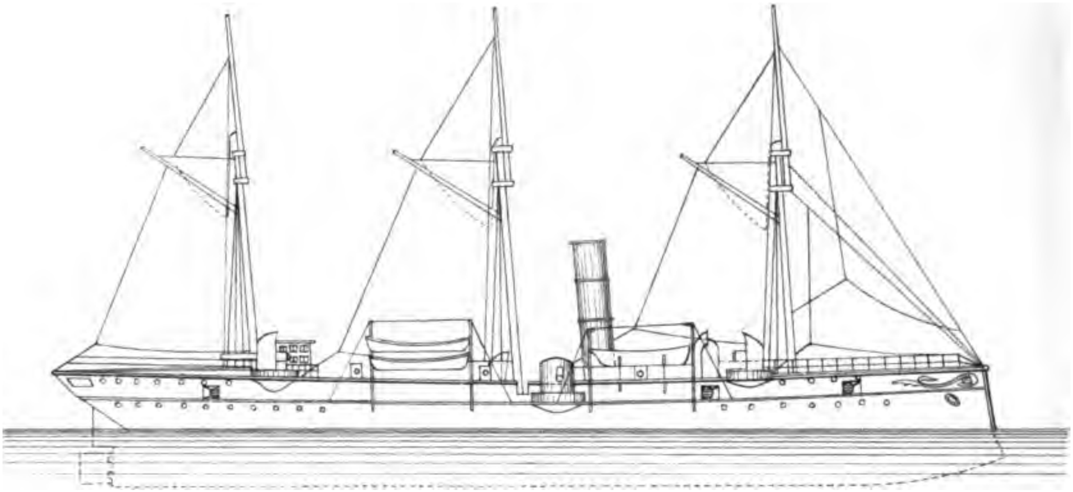


HANHART, LITH.

Pl. 145.

AMERICA—UNITED STATES SHIPS.

Torpedo Cruizer of 1700 Tons Displacement.



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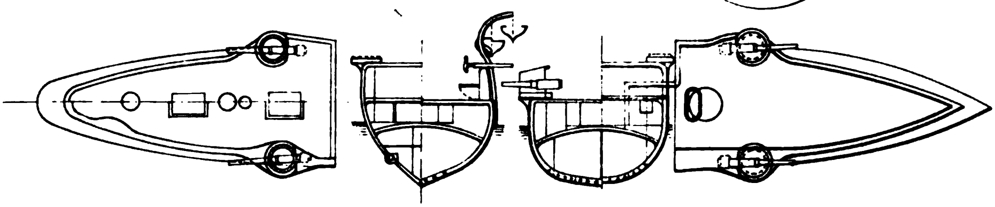

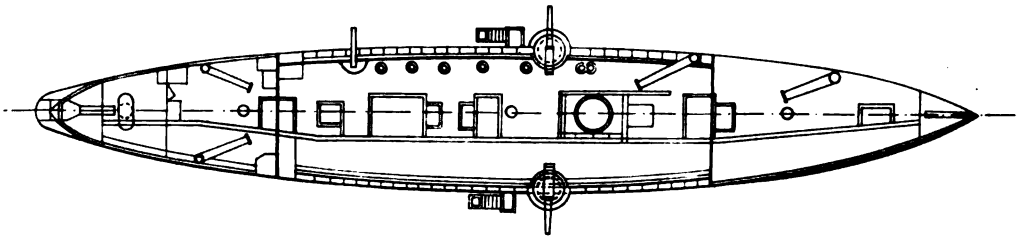

HANHART, LITH

"Newark."

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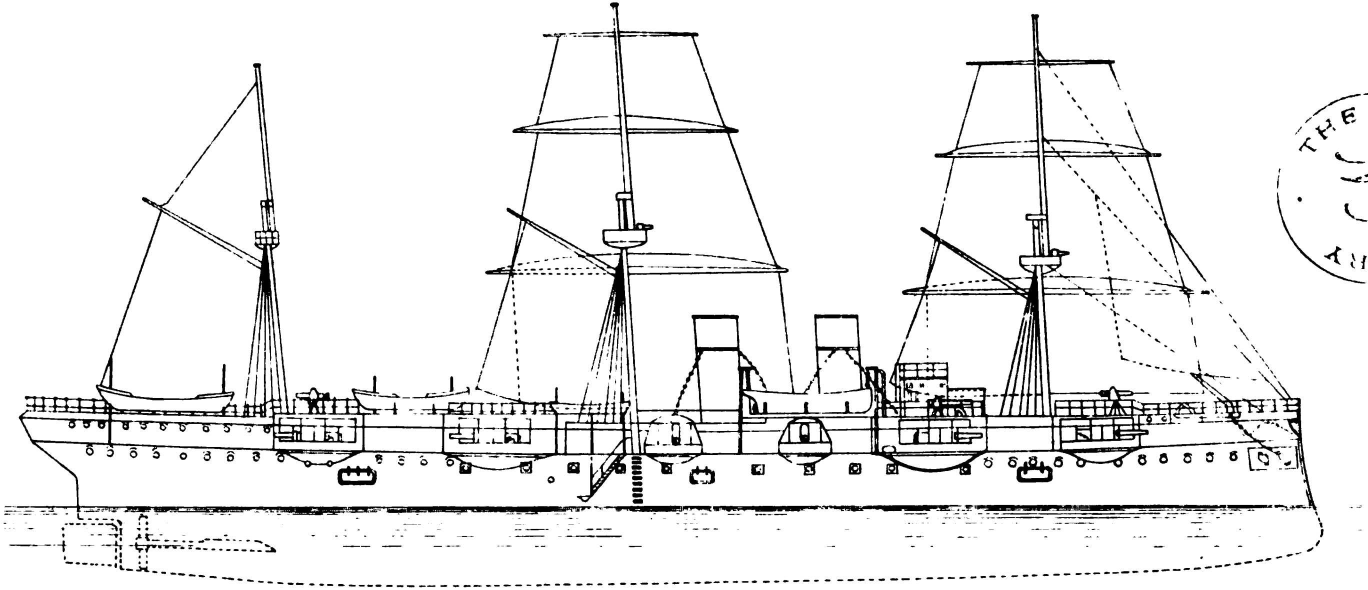

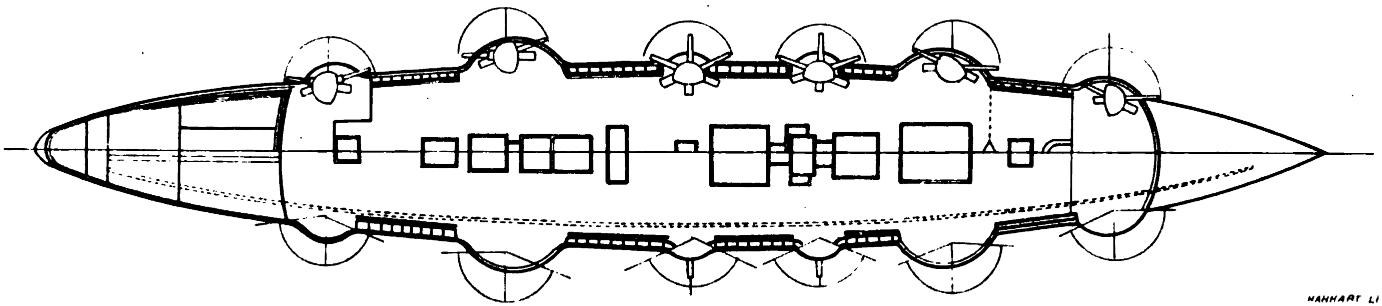

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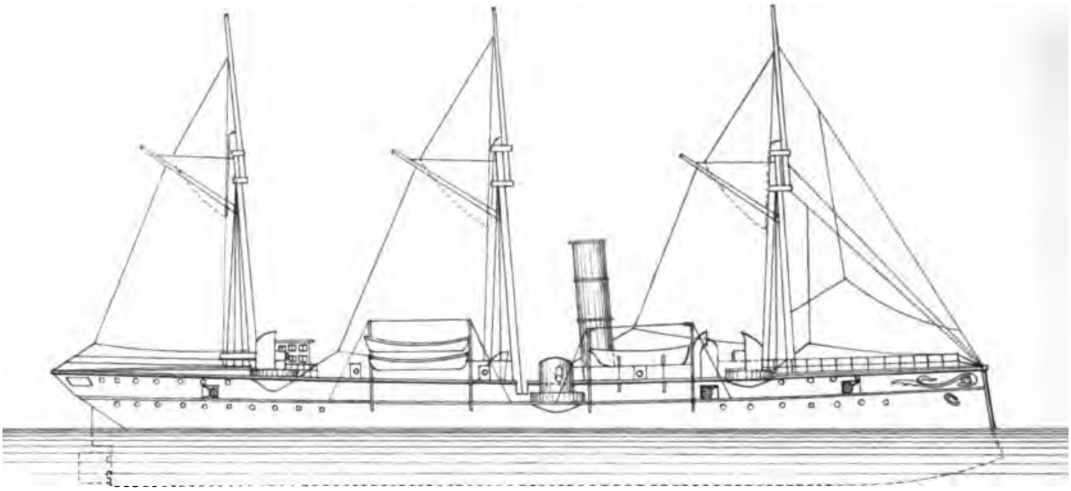
AMERICA—UNITED STATES SHIPS.

Torpedo Cruizer of 1700 Tons Displacement.



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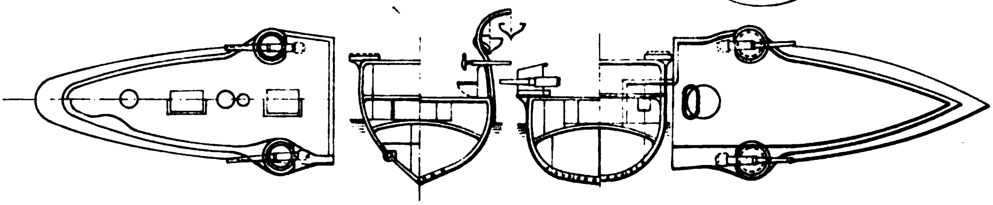

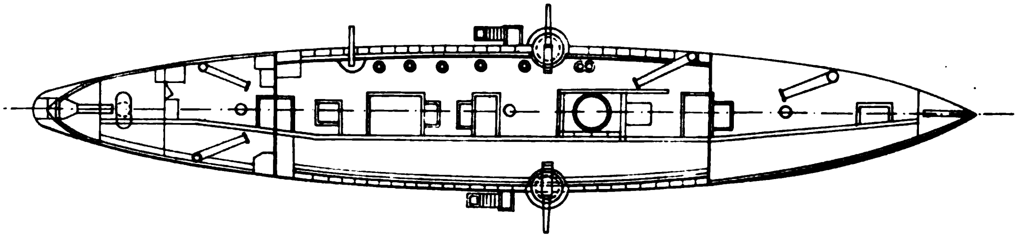

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Sf. 146

AMERICAN SHIPS.

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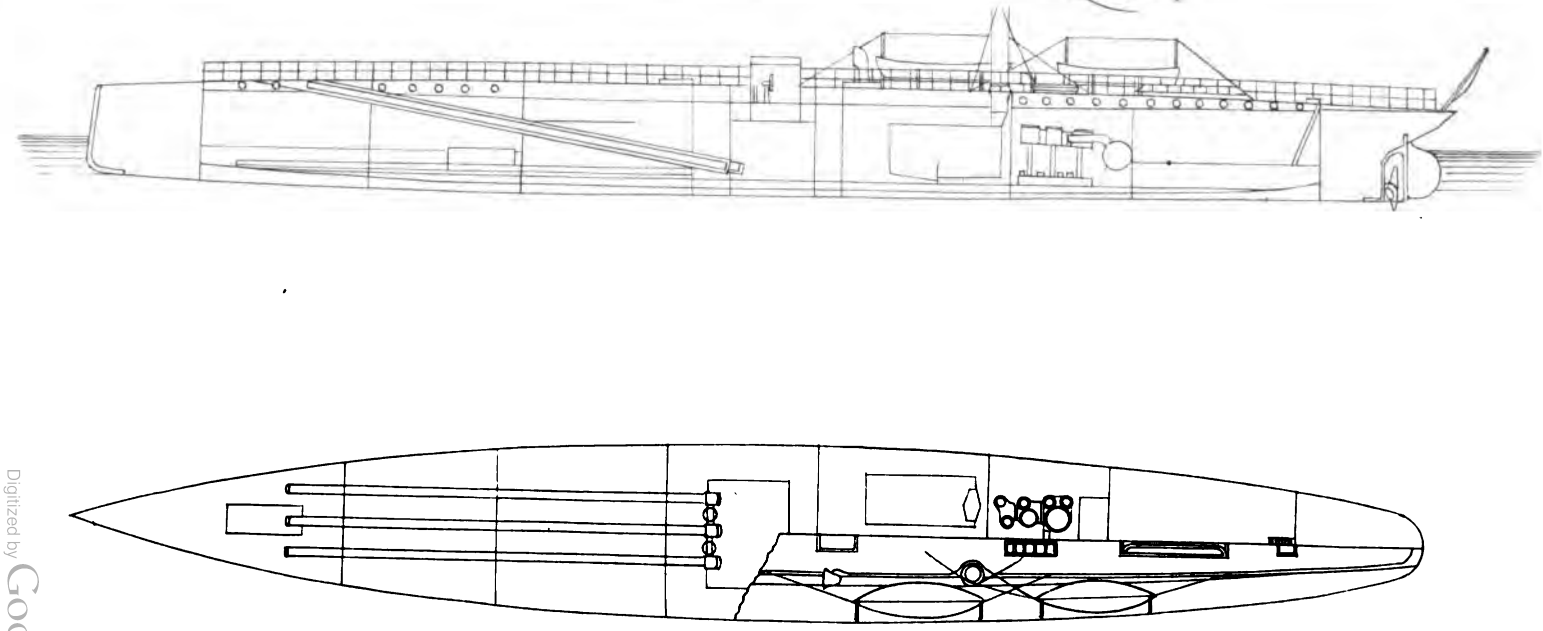
Dynamite Gun Cruiser.

on Special Scale



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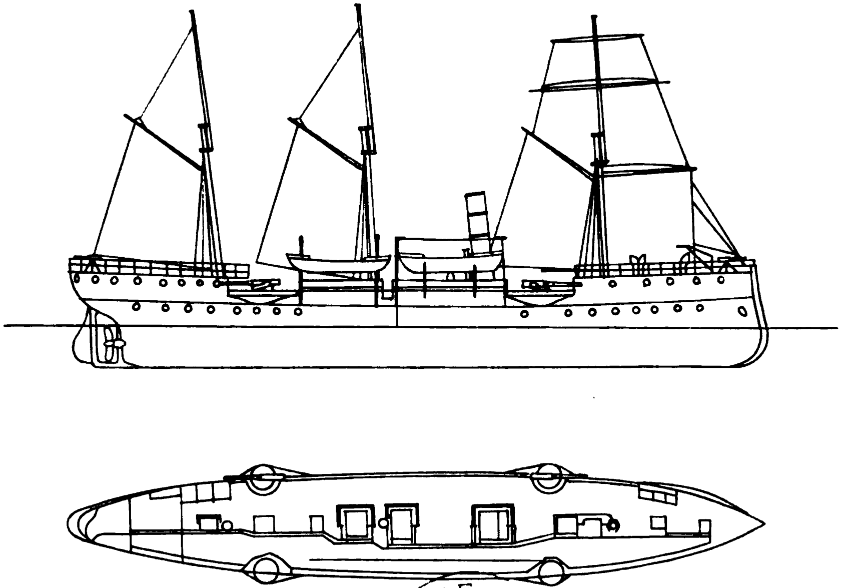
AMERICAN-UNITED STATES-SHIPS.

New Gun Vessel

of 870 Tons Displacement.



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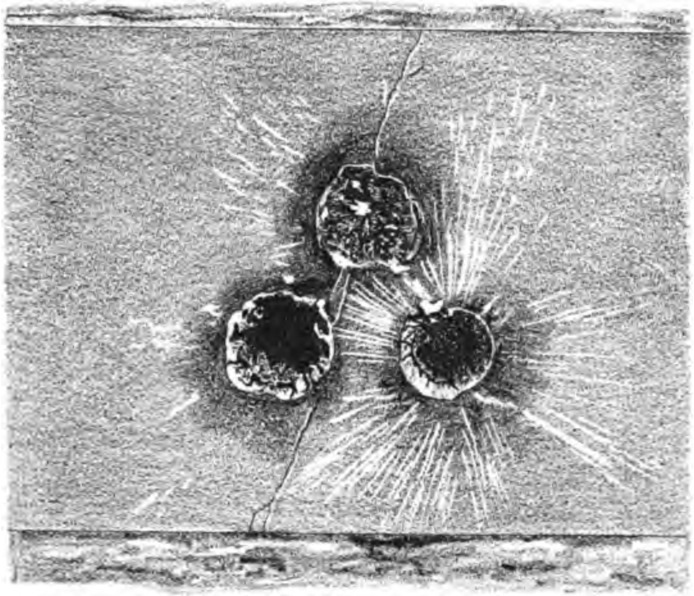
SECTION III.

ARMOUR AND ORDNANCE

The following pages have been mainly compiled by **Captain Orde Browne**, R.A., Lecturer on Armour at the R. A. College, Woolwich. Captain Browne has also supplied the Plates and Illustrations.

Pl. I.

FIG. I. SCHNEIDER STEEL PLATE FOR AMIRAL BAUDIN
TESTED AT GAVRE
MARCH 7, 1884.



WILSON COMPOUND PLATES
TESTED AT AMAGER, AUG. 6 & SEPT. 10, 1885.

FIG. 2.

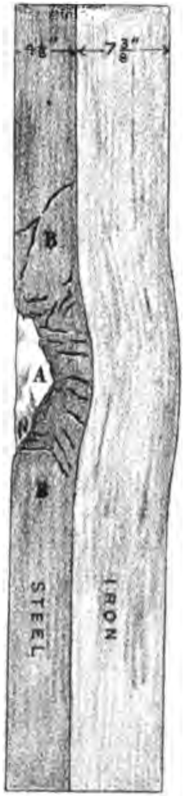
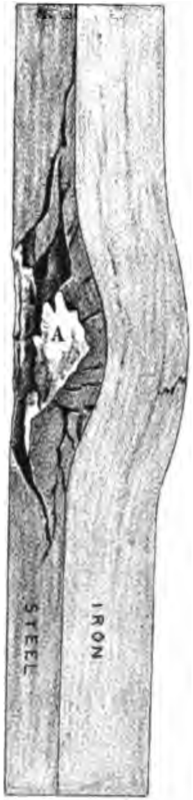


FIG. 3.



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Pl. II.

FIG. 4.

MOUGIN IMPROVED CUPOLA FOR LAND FORTS, 1887.

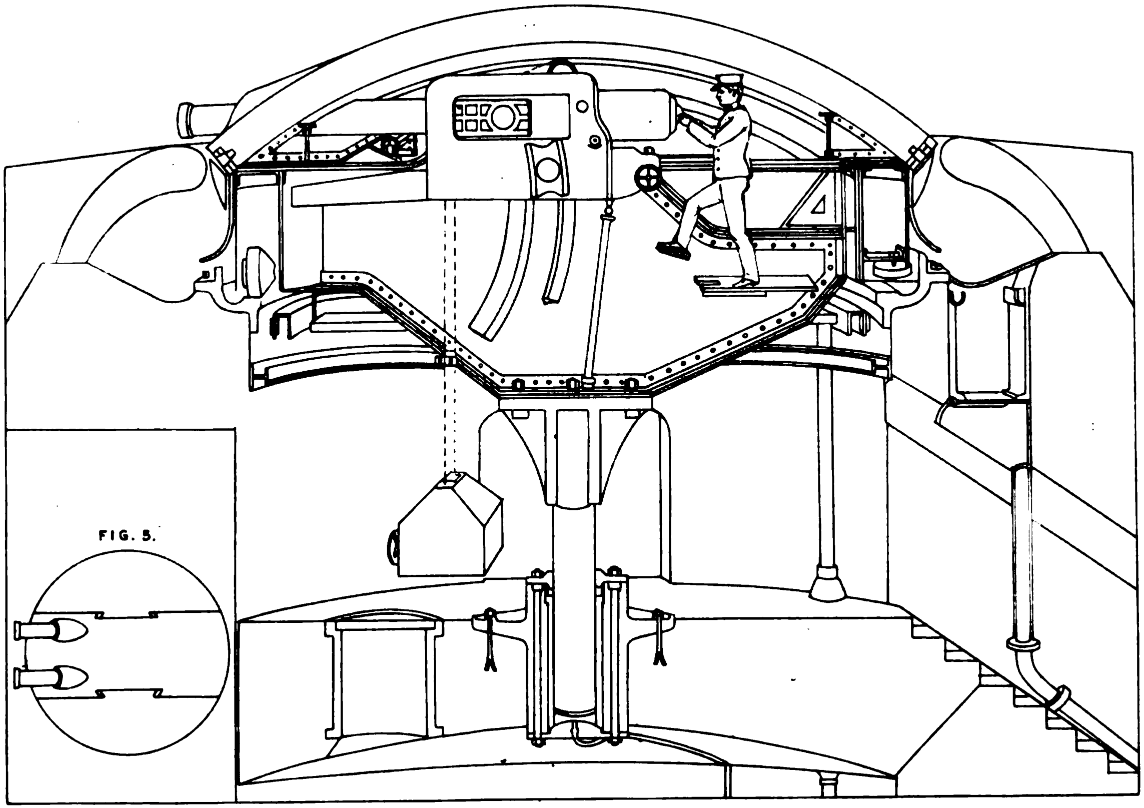

FIG. 5.

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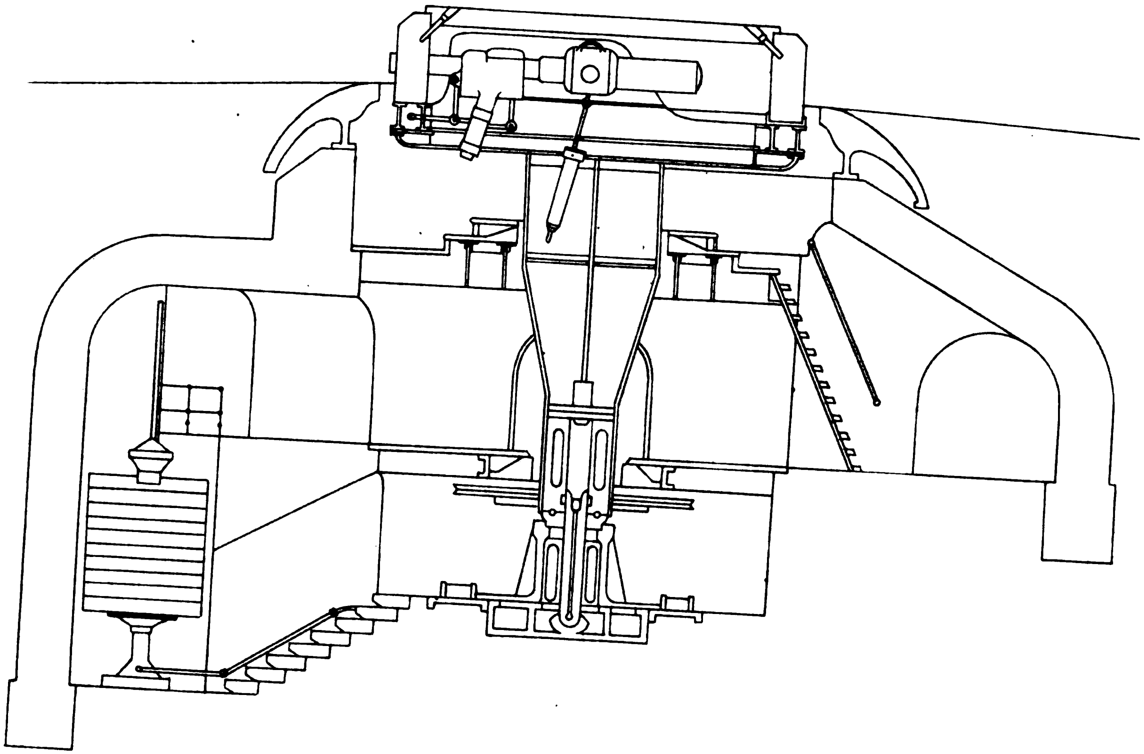
Pl. III.

FIG. 6.

NEW FRENCH DISAPPEARING TURRET, 1887.



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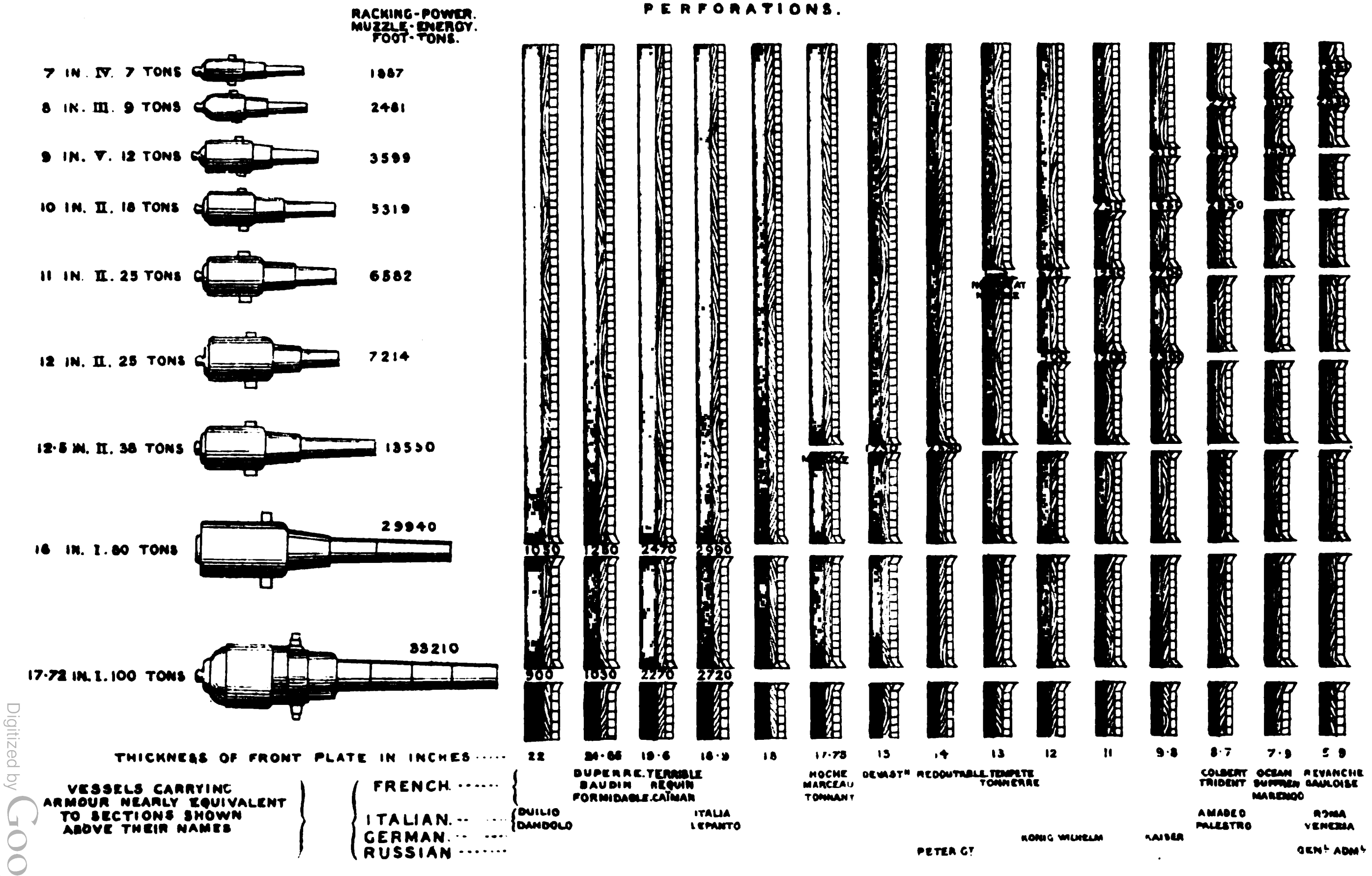
BRITISH M.L. GUNS.



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE – 20 FEET TO AN INCH.   SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

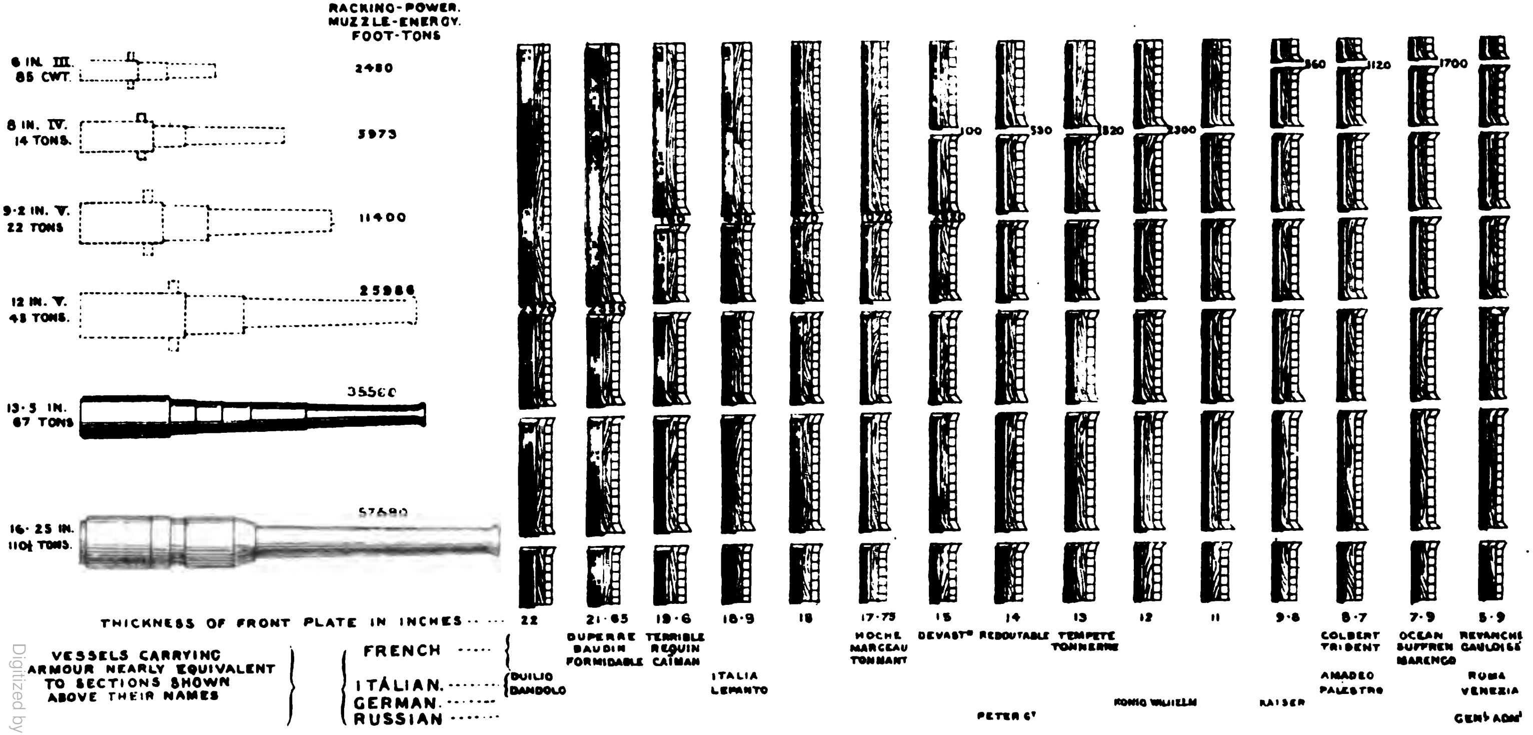
ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN. SKIN.

THE ... OR L... NY ... Y

Pl. V

BRITISH B.L. GUNS.

PERFORATION



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE – 20 FEET TO AN INCH. SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN SKIN.

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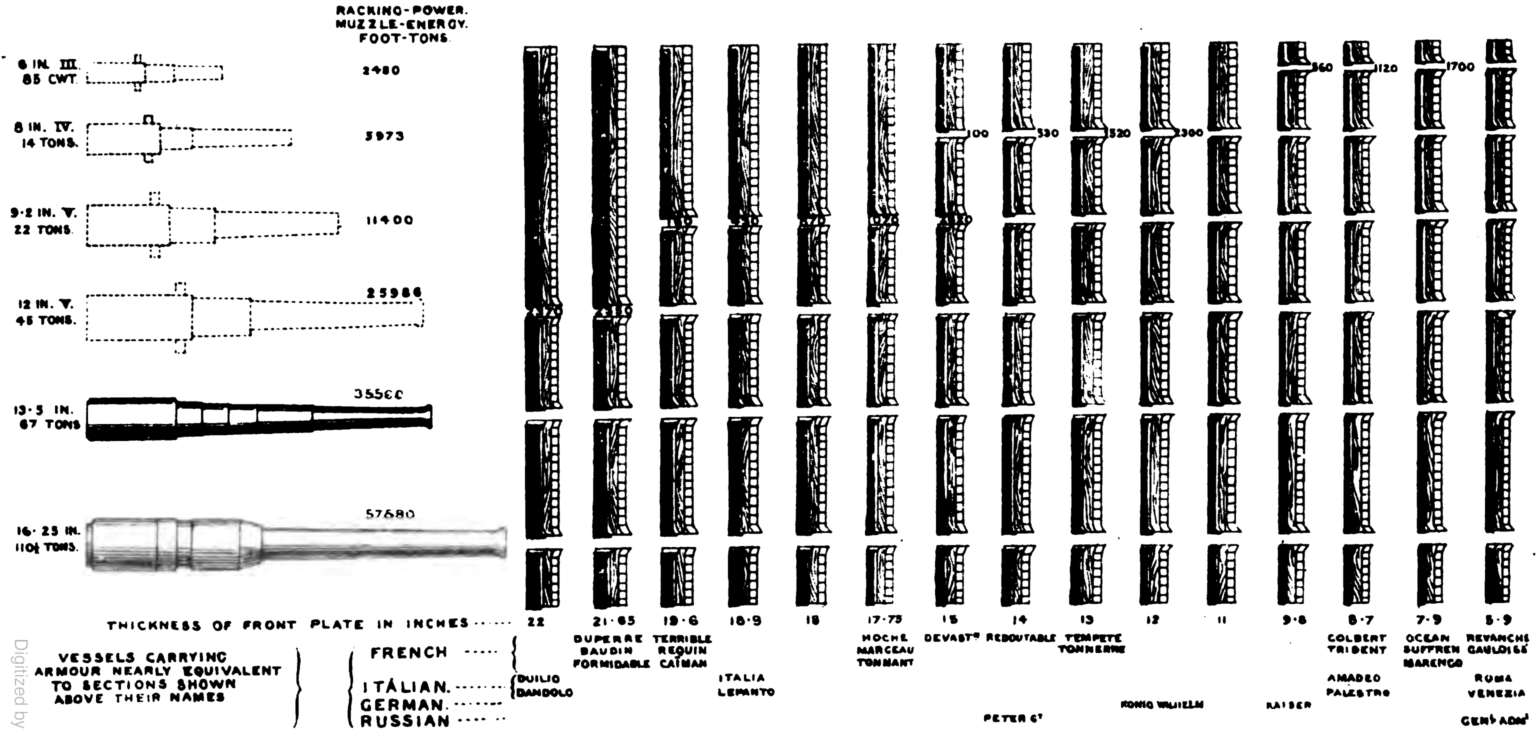
Pl. V

BRITISH B.L. GUNS.

PERFORATION.



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE - 20 FEET TO AN INCH.

SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN. SKIN.

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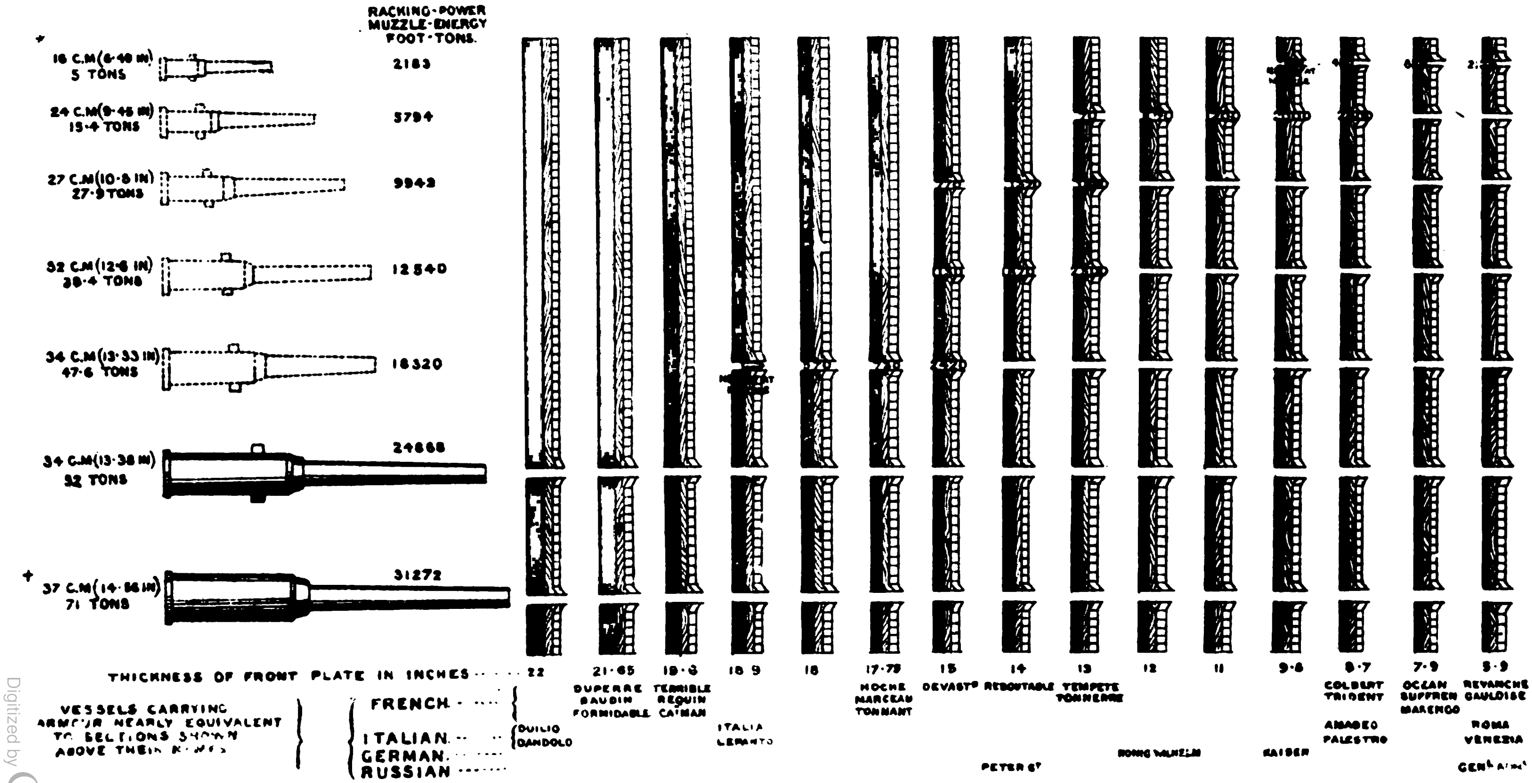
Pl. VI.

FRENCH GUNS.

PERFORATIONS.



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE - 20 FEET TO AN INCH. SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN SKIN.

* THE PATTERN OF 1881 NOW SHOWN IN TABLE OF FRENCH NAVAL ORDNANCE, IS LONGER & MORE POWERFUL THAN THIS PIECE.

+ A GUN OF 42 C.M. OF OLDER TYPE PATTERN 1875 WEIGHING 74·6 TONS IS THIS YEAR SHOWN WITH MORE ENERGY AND GREATER PERFORATION THAN THE 37 C.M GUN HERE DEPICTED SEE TABLE OF FRENCH NAVAL ORDNANCE.

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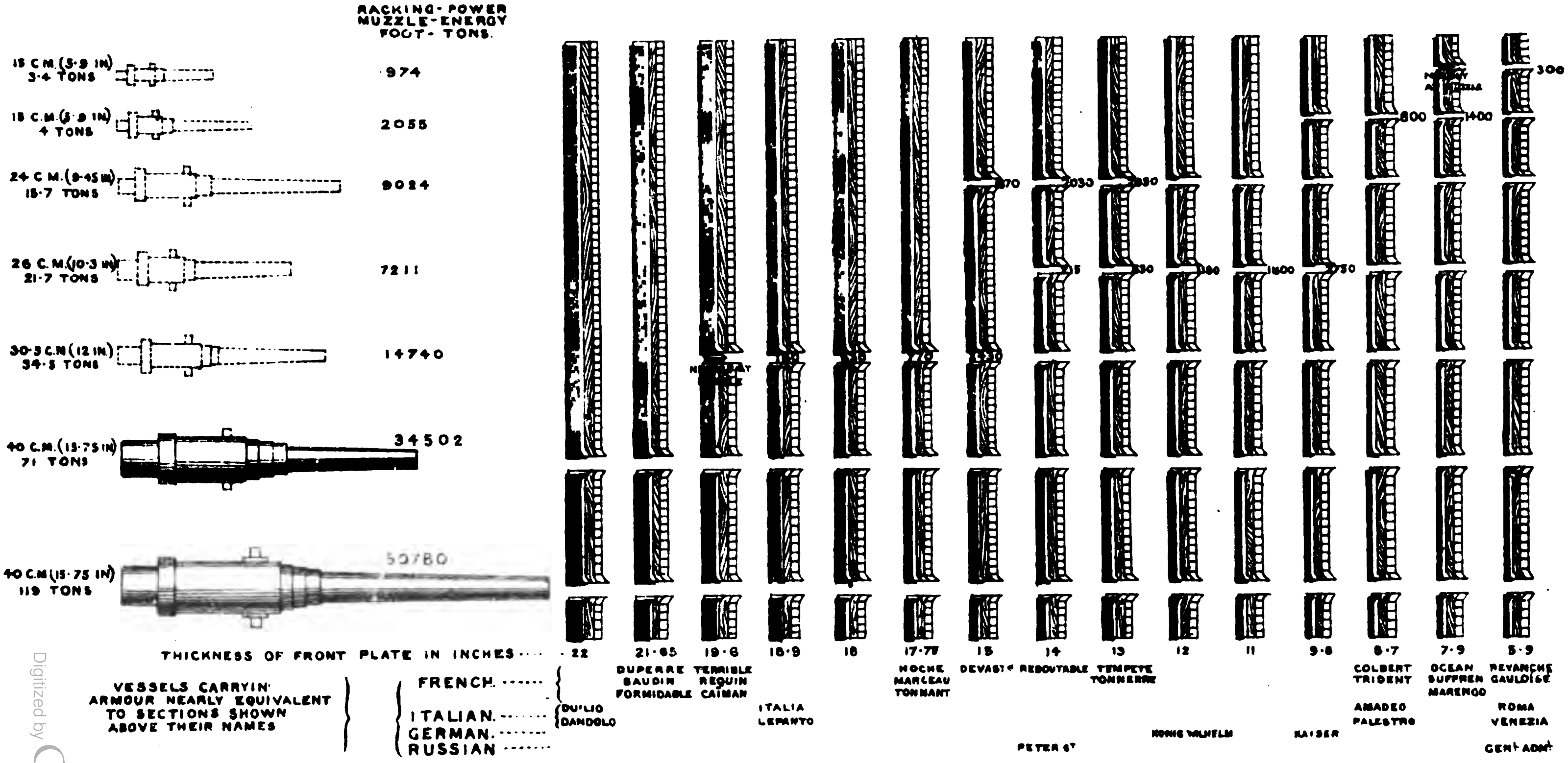
GERMAN GUNS

PERFORATION



A HOLE WITHOUT FIGURES MEANS PERFORATION UP TO 3000 YARDS: MAXIMUM RANGES OF PERFORATION LESS THAN 3000 YARDS ARE MARKED IN FIGURES.

SCALE – 20 FEET TO AN INCH.

SHADED GUNS ARE CORRECT IN GENERAL OUTLINE, DOTTED GUNS ONLY AS TO LENGTH.

ALL BACKING IS 18 IN. OF WOOD WITH 1½ IN. SKIN.

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ARMOUR AND ORDNANCE.

CHAPTER I.

ARMOUR AND ARMOUR EXPERIMENTS.*

Steel Projectiles.

THROUGHOUT the latter part of 1886, and during the present year, trials of steel projectiles have been conducted at Shoeburyness, shells of forged steel, supplied by Firminy and Holtzer, producing results far better than those obtained with projectiles formerly made in England. In March 1887, a "lot" of Holtzer projectiles was supplied which were proved and found to be of excellent quality, and were passed into the Service. At the same time, other steel projectiles failed from various causes, some of them breaking spontaneously in store. Messrs. Hadfield, of Sheffield, submitted cast steel shot for trial at Shoeburyness, which gave very good results; and subsequently, to meet the demand for forged steel projectiles, the same firm supplied an excellent 6-inch forged steel shot, which first suffered some slight deterioration from an accident. It was in the first instance fired from a piece with a worn bore, which required a special driving ring. It thus missed the mark, and entered a framework of metal and granite, and its point was slightly injured. It was afterwards fired, however, through an 8-inch compound plate, which it perforated, as well as 2 feet of oak, penetrating 32 inches into granite, where it eventually broke without setting up. Projectiles have been promised from Sir J. Whitworth & Co., but have not yet been delivered. There is every reason to expect that encouragement is only needed to cause excellent steel projectiles to be furnished by English makers, but considerable efforts will be necessary to provide any sufficient store for service. The best forged steel projectiles contain under 0·9 per cent. of carbon. They are made sufficiently soft to shape with a tool all over from point to base. They are then hardened, and finally they are ground, as far as may be necessary, to bring them to exact dimensions at the shoulder-bearing ring. French steel projectiles contain from 1 to 2 per cent. of chromium. A sample of Krupp's projectile fired at Spezia in 1886 contained nearly 0·9 per cent. of carbon, but no chromium. Some very successful Firminy projectiles show signs of having been hardened to such an extent that a concentric structure is developed, the surface scaling off on impact.

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* *List of Authorities.*—The cuts and facts relating to experiments are chiefly taken from the *Engineer*. Reference has also been made to Shoeburyness and to manufacturers of war matériel.

Steel and steel-faced armour.

A vigorous attack has been made on steel-faced plates, led by Lieut. Jacques, U.S. Navy, in a pamphlet entitled 'Modern Armor for National Defence.' The writer in this states that the all-steel (Schneider) plate has been the victor in all the latest competitive trials. He quotes Admiral Simpson, U.S. Navy, who favours solid steel. He gives cuts of plates tested at Gâvre for the Furieux and Amiral Baudin, and of the Schneider steel, and Brown and Cammell steel-faced plates tried at Spezia in 1884, after the first round fired from the 100-ton B. L. gun. He remarks on the superior resisting powers exhibited by the Schneider solid steel, and notes that the Italian Government have decided to manufacture steel armour at Terni, near Rome. Lieut. Jacques finally concludes that steel is the best material for the armour of ships and fortifications. This pamphlet was followed up by a number of statements in American * publications, and in English papers. Articles then appeared in other papers † expressing views which were opposed to those of Lieut. Jacques. The matter may be thus summarised:—

In all competitions between compound and solid steel plates of 12 inches thick, compound plates have had the victory, namely, at Amager, Ochta and Pola. At Spezia, on the other hand, solid steel has been pronounced to be the better after repeated trials with 18·9-inch plates. Compound plates have been hitherto made soft and flexible in the mass, because the Admiralty authorities decided from the first, that "through cracking" was to be at all costs prevented as far as possible; the conditions of approval for service being that no through cracks shall be made by the first round fired, while it is further stipulated that no one of three projectiles should get through the plate. Chilled iron shot have hitherto been employed in proof both of English and French plates. They are known to be very inferior projectiles, and their use may well have prevented the plates of either nation being developed in the best way to resist the attack of forged steel shot or shells, such as would in future be employed.

The English steel-faced iron plates have very hard faces, but, to resist cracking through, the backs require to be made of iron of low elastic limit, as it has been proved that metal, even with great power of elongation, refuses to stretch under a blow, but rather cracks through, unless its elastic limit is low. Consequently, English steel-faced plates are in the mass soft and flexible, and need to be well backed to exhibit their full powers of resistance. Solid Schneider steel plates may be made very soft, when they approximate wrought-iron in quality, or on the other hand they may be made hard enough to resist perforation well; but in this case they are apt to crack through, when their further resisting power depends on how well the fragments are held up by bolts.

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* *Army and Navy Register*, Nov. 27, 1886; and *Engineering*.

† *Army and Navy Journal*, March 12, 1887; also articles in the *Engineer*, by the Author.

French steel plates.

To resist forged steel projectiles, it is probable that English plates may be made harder, some relaxation in the condition as to through cracks being allowed. In this case, compound steel plates—that is, plates made with hard steel faces united to soft steel foundation-plates or backs—might come in. It does not seem possible to give to a solid plate, made of one steel throughout, the desired hardness in the face and toughness in the back. The harder steel plates have proved very uncertain in their character. Out of 90 plates supplied for the French Terrible 18 are said to have cracked spontaneously. A special test has been instituted, which consists in dropping the plate from the height of about a metre on an iron floor. Fig. 1, Pl. I., shows the Amiral Baudin plate selected by Lieut. Jacques as a very good example to illustrate the resisting powers of Schneider steel plates. As may be seen by the white splashes radiating from each point of impact, chilled iron projectiles, not steel, were used in the attack: the 32-centimetre (12·6-inch) gun was employed. The weight of the projectile was probably about 761 lbs., the striking velocities of the three rounds were 1518, 1518 and 1593 feet respectively. The energy of the last was therefore 13,390 foot-tons, or 378 foot-tons per ton of plate only, the plate being 12 feet 9 inches long, 8 feet 2 inches broad, and from 18 to 20 inches thick, and weighing about 35·45 tons. The three blows together only amounted to 1064 foot-tons per ton of plate, even had the projectiles lost nothing by breaking up. The plate appears to be broken across, and its success is not therefore very remarkable. In steel-faced plates, "through-cracking" is checked not only by the quality in the back portion or foundation-plate, but also by the want of homogeneity brought about by the construction of the plate in layers. Figs. 2 and 3, Pl. I., are remarkable illustrations of this action. They represent Wilson's steel-faced plates tested at Amager on August 6th and September 10th, 1885, 5 feet square by 11·5 inches thick. The steel was 4⅛ inches, and the iron 7⅜ inches thick. The plates were actually cut in two to furnish sections after the trial. Fig. 2 shows the effect of a 10-inch chilled iron Ankarsrum projectile, weight 181·5 kg. (400 lbs.), with a striking velocity of 423·6 metres (1390 feet), an energy of 1660 metre-tons (5358 foot-tons), a perforation of 13·4 inches of iron and an energy per ton of plate of about 1040 foot-tons, supposing the plate to weigh 5·15 tons. A few face cracks only were formed, and the behaviour of the plate in stopping the shot is very satisfactory. Fig. 3 is a more important example, because a forged steel projectile was fired weighing 182·5 kg. (402 lbs.) with a striking velocity of 438 metres (1437 feet), an energy of 1784 metre-tons (5760 foot-tons), a perforation of 13·9 inches of iron, and energy per ton of plate of 1118 foot-tons. The steel shot would deliver a much larger proportion of its energy before breaking up than a chilled projectile. A plate seldom survives *a single blow* of 1000 foot-tons per ton of plate. The Amiral Baudin plate above referred to received a total of only 1064 foot-tons in three blows.

On the whole, should the condition stringently forbidding through cracks be modified, harder armour may probably come into use, but it appears as if compound plates with hard steel faces and foundation plates of either soft steel or wrought-iron ought to succeed better than plates made of one steel throughout, whose face can only differ from its back to the extent that may be produced by hardening.

In the course of the next few years the powers of each class of armour will probably be abundantly tried.* Italy is pushing forward steel, as may be seen from the following extract from the *Engineer*.

"A Government small-arms factory had been in existence for some years at Terni, which is situated about a three hours' journey on the railroad from Rome to Ancona," "a company 'Società Anonima degli Alti Forni Acciaieria e Fonderia de' Terni' has been formed, in which, it is believed, the Italian Government, and the firm of Schneider & Company of Creusot, are interested. The works have been established with the object of manufacturing steel armour plates, heavy ordnance and rails, which hitherto had been imported from abroad, mostly from France, and so of making Italy independent of foreign countries."

The United States Government have issued a circular to manufacturers "embodying information for those who intend to bid upon gun steel and armor for the navy," stipulating for the provision of steel plates.

France is now making but little armour for ships. Orders are given to makers of steel and steel-faced armour in equal quantities, but French naval officers are inclined to prefer the solid steel. Nevertheless, the employment of steel-faced plates for a land cupola (*vide* Pls. II. and III.), where the plates themselves form the structure, instead of being bolted on to a framework, seems to show the recognition of the tendency of steel to crack through, which in such a case would be fatal.

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* Preparations for the competitive trial of solid steel and steel-faced plates at Portsmouth are now going on.

In Germany, Austria and Russia steel-faced plates only are employed. The Argentine Republic, Brazil, China, Denmark and Holland also employ only compound. Sweden and Spain are trying steel. The makers of armour plates are for steel; Schneider at Creusot, and the Terni Company in Italy. For steel-faced plates, Brown at Sheffield (on Ellis' patent), and on Wilson's patent, Cammell at Sheffield; Marrel at Rive de Gier, Loire; La Compagnie Anonyme des Forges at Paris; La Compagnie des Hauts Fourneaux, St. Chamond; the Dillingen Works, in Germany, and Tjora Iron Works, Kolpino, St. Petersburg.

Reports on Bucharest turret competition.

With regard to continental armour experiments, various reports have been presented on the Bucharest competition. Those written in Germany and one by Franz Klotzmann, Chief of the Engineer Staff in Vienna, give the preference to the German cupola of Schumann, while French reports are in favour of the French turret of Mougin. The British report, drawn up by Major O'Callaghan, R.A., and Captain Clarke, R.E., is likely to be as disinterested and free from prejudice as any. It is, in fact, careful and scrupulously fair. Both turrets are said in this report to fall short of the requirements of the case, especially in the power of the guns mounted in them. The expense of a cupola would not be a wise investment unless the most powerful guns of the calibre dealt with are employed; and to prove the turret, the attack should be made with the most powerful siege guns. "Summing up," the report says, "the main advantage of the German cupola was its form; and the main defect, the detachment of the interior bolts and rivets. In the case of the French turret, the principal merits were the floating pivot and the absence of an inner skin; while the chief drawbacks were the want of any means of direct laying, the bad ventilation, the complication and general inconvenience of the interior, and the greater cost of the emplacement.

"By combining the best features of the two designs, it is possible that a satisfactory military machine could be arrived at. A cupola with a wrought-iron umbrella-shaped shield, supported on a floating pivot and armed with guns provided with a recoil mounting and port pivoting, might meet all requirements."

Major Mougin himself could hardly find fault with this recommendation, seeing that since the Bucharest competition he has brought forward another design which exactly meets the demands of Major O'Callaghan and Captain Clarke. This is exhibited in Fig. 4, Pl. II. It will be seen that Mougin has here adopted the German mushroom form of dome, while his gun is separate from the shield, and he retains the floating pivot of his Bucharest turret. He has adopted a system of jointing for the roof, shown in Fig. 5, which appears good and less liable to dislocation than one following radial lines.

French Disappearing Turret.

A disappearing turret is proposed in 'Le Génie Civil' of the 15th of January, 1887. This is shown in Fig. 6, Pl. III. It will be seen that the turret is cylindrical. The interior diameter is 15 feet. The vertical wall, 3 feet 11¼ inches high, is formed of three plates fitted together by tongues and grooves. The roof plate is 7·87 inches thick; a liquid press pivot is employed. The total weight is 147·63 tons. The plunger, 17·72 inches in diameter, supports the whole structure when the liquid is under pressure of 100 atmospheres. A counter-weight and accumulator are employed to facilitate raising and lowering.

A disappearing turret would undoubtedly possess the advantage of being able to come into action and go out of action as might be desired. When in action, however, it may be questioned if it would obtain the full advantage of cover that might be expected, seeing that an adversary who loaded quickly would always be laid on the spot waiting for its appearance after each round.

A trial of Grüson's chilled-iron armour is contemplated shortly in this country.*

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* A complete account of this armour, from its first trial up to the present time, has been written by Grüson's engineer, Julius von Schütz, which has been translated into English by Capt. Grenfell, R.N. The most important recent results obtained with it are narrated in *The Naval Annual* for 1886, p. 317.

CHAPTER II.

ATTACK OF ARMOURED STRUCTURES.*

Comparison of wrought iron and Grüson's armour.

It seems especially necessary to point out the great difference that exists between wrought iron and chilled iron, because they suffer in different ways, and can best be attacked by different projectiles. At the present time any foreign fleet lying off a foreign armoured fort, would furnish an example of two very distinct kinds of armour, for the older ships would as certainly be clad in iron as the forts would be covered with Grüson's chilled iron armour. Wrought iron must be perforated. Chilled iron must be fractured. The former is effected by shot in proportion to their powers of perforation. The latter probably in proportion to their total energy. What is especially liable to mislead is the fact that guns' powers are generally estimated according to perforation. How different may be the powers of guns against soft armour like wrought iron, and hard armour like Grüson's, may be seen from the following example.

In Copenhagen, in March, 1883, a Krupp gun, 15 cm. (5·9 in.) and an old type Armstrong 9-in. gun were used together against the same target. Their respective energies per inch circumference were 123 and 118 foot-tons, so that in perforating power the Krupp gun had a slight advantage. Their total energies, however, were 5760 and 16,403 foot-tons, so that the Armstrong projectile, if fired against armour which could not be perforated (for example, against chilled iron forts), would have nearly three times the effect, having nearly three times the total energy of the Krupp projectile. Speaking generally, the new type guns would display their powers best against ships, for though total energy and racking power have been increased in these guns, it has not been at all in proportion to the increase in power of perforation, because the small calibre assists perforation, but does not affect the question of total energy and total smashing blow.

Generally speaking, then, the older-fashioned guns might do better against forts than might be expected, while any smaller new-type guns would only display the full powers with which they are generally credited, against ships or other structures covered with armour sufficiently soft to admit of perforation.

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* This is reprinted, with a few alterations and corrections in both text and plates, from the *Annual* of 1886.

I.

Remarks on the Attack of Armoured and Unarmoured Structures.

Certain parts of a ship are of the most vital importance, such as her magazines and boilers, and a sufficient number of cells to keep her afloat. Some of her guns and engines may be included in the same category.

Such portions are specially protected by armour, and their attack, while it is the most decisive that can be made, if successful, calls for guns of definite power suited to the circumstances of the case. This species of attack has been termed, for the sake of distinction, *the primary attack.*

On the other hand, there exist in all vessels portions that are slightly protected or altogether unprotected by armour, and consequently subject to injury from light ordnance, and these parts have augmented in number as armour has become more and more limited in area, owing to the necessity of increasing its thickness in order to obtain greater security for the vital parts above mentioned against modern guns. Such unprotected portions will be found to include objects whose destruction, though not vital to the existence of the ship as a fighting machine, would still cause great inconvenience.

For example, the captain and the focus of all the communications to the various parts of the ship may sometimes be imperfectly protected; and though one or more alternative centres of command may and do generally exist, yet the destruction of the primary one must cause serious inconvenience.

Then again holes in a ship immediately over the water-line armour belt, especially well forward, will, under many circumstances, cause an inconveniently large quantity of water to enter, and ships may be seriously hampered by the destruction of parts of less direct importance if effected on a large scale. The employment of artillery fire with this object has been, for the sake of distinction, termed the *secondary attack*, and this forms the natural work for any pieces that cannot hope to achieve success in the *primary attack*.

In many cases in action it may be necessary to fire without the opportunity being given for careful discrimination. In some instances, however, where the enemy's ship is well known, and the firing is deliberate, it may be important both to aim systematically and to assign work to guns that they are capable of performing.

Thus in pursuing a ship, it may be important to know whether her steering gear can be easily reached and disabled, as in the case of the Huascar, or whether, as in the case of a ship with twin screws, it may be specially well protected. Before discussing further the primary and secondary attacks, it may be mentioned that there exists another form of attack which cannot exactly be included in either, as its possibility depends wholly on circumstances. This is the attack of decks. This attack may be of the most dangerous character, and may occasionally be undertaken by comparatively insignificant pieces of ordnance, but ships only subject themselves to it under special conditions, and generally speaking knowingly.

Primary attack. For this it is as important to know the nature of an enemy's armour as to know its thickness.

Armour may be classified as *soft* or *hard*, and dealt with accordingly.

Soft armour (including wrought iron in any of its forms except steel-faced) can hardly be broken up, and is practically uninjured by partial penetration, however often repeated. It is therefore useless to fire shot that cannot penetrate it completely, because each effective round must *perforate* (that is, completely penetrate) the armour and work mischief independently of the action of other rounds fired.

Rule of thumb.

The following *rule of thumb* admits of proof on certain assumptions, and may be found useful.

Take the calibre of the gun as a measure of the armour, and it will be found that no shot can perforate a plate, unless it has over 1000 ft. velocity for each calibre in the thickness. Thus an 8-in. projectile must have over 1000 ft. striking velocity to perforate an 8-in. plate. It must have over 1500 ft. velocity for a 12-in. plate, over 2000 for a 16-in. plate, and so proportionally.

For many new-type guns firing projectiles heavy in proportion to their calibre, the direct perforation is very close to one calibre for every 1000 ft. striking velocity.

In *oblique fire* the perforation is found by multiplying the direct perforation into the sine of the angle made by the axis of the shot with the face of the plate, unless this angle becomes too oblique for the shot to bite, which will generally be the case below 45°, even with armour below the power of the shot. At sea this calculation is seldom useful because the angle of incidence is seldom known,* so that the maximum effect possible (i.e. direct perforation) is more important. In a siege, however, oblique perforation might be required.

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* A vessel attacking a fort might increase the resisting power of her side armour by maintaining an oblique position.

Old-type guns and a few new guns firing projectiles of large calibre in proportion to their weight, have less penetration than that given by the above rule; while guns of the future with a calibre which is very small in proportion to their weight, may obtain greater perforation than given by the rule of thumb if fired under very favourable conditions.

On the whole, then, it may be concluded that it is useless to fire at wrought-iron plates with less than 1000 ft. striking velocity for each calibre in the thickness of the plate attacked, further allowance being necessary with old-type guns, in oblique fire, and also some allowance for backing.

Diagrams.

For immediate use in connection with service guns, projectiles and charges, General Inglis prepared a diagram on which perforations can be read off at a glance. If the charge differs from that specified on the diagram, the perforation for any given velocity is correctly shown, but the range at which this is marked will no longer be correct.

Colonel Maitland has a diagram which may be employed for any question of perforation of iron. It is less quickly used and less simple than that of General Inglis, but it is available for experimental and irregular conditions, it gives more information than any other, and in using it an actual process of calculation is mechanically performed, which is perhaps more perfect in theory than any other known in England.

The accompanying diagrams, Pls. IV., V., VI., and VII., are based on a series that owe their origin to the official one prepared by Colonel Noble in 1873. Foreign ships were given by Captain Grenfell, R.N., in 'Engineering,' and have been shown for some years past in the Austrian 'Marine Almanack' as well as in the 'British Navy.' To give to these diagrams a definite practical character, the following course has been followed.

On the supposition that 3000 yards is the maximum range at which side armour will be systematically attacked, all projectiles perforating up to 3000 yards are shown with a clear blank hole. For every perforation effected only at shorter ranges, the limit of range is entered in or near the hole. Thus, any officer finding armour corresponding to that of his enemy with a blank hole opposite his gun on the diagram, may hope to perforate *with a direct hit* at least up to 3000 yards. Should he find a number less than 3000 yards entered, he must not expect to perforate beyond the range so entered.

The armour is wrought iron. It is only approximately representative. The types are chiefly French. The perforation includes backing and skin.

Colonel Maitland's diagram has been used for calculating loss of velocity at each range. On service each hit would have less power to perforate than is indicated on the diagrams, in proportion as it strikes more obliquely.

The diagrams must be regarded as only approximate. They may however be of practical value, for an officer may be able to see at a glance that some ship's armour is *well within the power of his guns* or *quite beyond them,* and behave accordingly.

On this, *vide* Remarks on the Attack of Armour, p. 432.

All armour-clad vessels built prior to 1876, and many subsequently, are *iron*-plated. To these the above directions apply. For example, suppose 10-in. M. L. guns to attack the French vessel Redoutable, carrying 14-in. plates along her water-line, and 9½-in. plates on her central battery, the above rule would indicate that it would be useless to attack her water-line with less than 1400 ft. striking velocity, and her battery with less than 950 ft. Now the 10-in. 18-ton M.-L. gun has a muzzle velocity of little over 1364 ft., and even if by a special charge it were brought up to 1500 ft., it would be right for such guns, even at the shortest ranges, to attack the central battery and not the water-line, for something must be allowed for backing, probable obliquity of impact, and range. The Redoutable, like some other French ships, has an unarmoured battery which might be attacked by any ordnance. The question may naturally be asked, why ships clad in steel and compound armour are treated as if only sheathed in the same thickness of wrought iron. The reply is that the object is to furnish a low limit for guns available for attack. In experimental firing, steel and compound plates have often been attacked and have suffered when projectiles have been employed just capable of perforating wrought iron of the thickness of the steel in question. The yielding is more or less by fracture, and is a gradual process; still it would not be right to fix the limit higher, and to say that guns capable of such effects were useless for attack of such armour. Moreover, no other limit could be taken, seeing that some very soft steel armour exists approaching wrought iron in quality, though how closely it is impossible to say.

Thus it may be laid down that steel or steel-faced plates may be attacked by guns capable of perforating wrought iron of the same thickness as the plates in question. There will, however, be gradual destruction instead of perforation.

Hard Armour.

Hard armour, then, including chilled iron and the harder steel and compound plates, cannot be perforated, and must be broken up before the structure behind it can be injured materially. A single hit will seldom do more than injure the armour itself. The harder kinds of such armour will suffer more than wrought iron from the continued fire of comparatively light guns. The smashing effect of a projectile on hard armour is probably in proportion to its *total energy*, irrespective of calibre. It is difficult to apply any rule to the case of hard armour, but it is desirable as far as possible to concentrate and continue the fire about the same spot, and all guns are available for such work. Such an operation may seldom be feasible in engagements between ships.

With regard to projectiles.—*Filled Palliser* shells are only effective against thin armour. *Steel shells* have perforated iron and even steel plates without deformation, and steel shells containing gun cotton bursting charges have occasionally been made to pass intact through thick wrought-iron plates, but not through any harder class of armour. *Common shells* have perforated unbacked iron plates half a calibre thick, that is to say, a shell of 16-in. calibre fired from the 80-ton gun has passed through an 8-in. plate, and a 10-in. common shell through a 5-in. plate.

Recent Order as to Palliser Shells.

It has recently been decided that no service armour-piercing projectiles shall be fired with bursting charges of "black powder." Forged steel shells require a stronger explosive to burst them. It appears to be thought that armour sufficiently thin to be successfully attacked with projectiles capable of being burst by powder would be better dealt with by common shell. This conclusion may possibly be based upon experiments with common shell and *backed* plates, of which reports have not been made public. In the engagement with the Shah the only loss incurred by the Huascar's crew was caused by a 9-in. common shell from the former ship, which perforated the waterline armour somewhat abaft the midship point, where it must have been about 3½ in. thick, and supported by backing. This shell exploded destructively between decks.

Experiments at Shoeburyness, on the other hand, have shown that generally the blunt head of a common shell breaks on impact, and the projectile perforates by driving out a disc of the plate in front of it. Backing enormously interferes with this kind of perforation. There still exist a sufficient number of vessels with thin armour to make this question important. The Huascar turret armour, 5½ in. thick, was perforated by two 9-in. filled Palliser shells, fired from the Cochrane or Blanco, which appeared to have burst inside. The destructive effect was very great, all the men in the turret being killed. It appears unlikely that a 9-in. common shell could perforate a 5½-in. plated turret, and a shot would surely do less damage inside.

Unarmoured parts of ships are probably most effectually attacked by common and shrapnel shells. The former act best with direct-action fuzes. The Pettman fuze has often failed to be set in action with new-type guns; also its action is apt to be too slow, so that the shells split open instead of bursting explosively. *Shrapnel* shell may be fired plugged, as the passage through thin iron breaks them up, and they make great havoc in the interior of an unarmoured ship.

Deck Attack.

Deck attack.—This is the attack of a ship's deck, either by guns firing from positions of high command or by vertical fire. A ship lying head-on is generally well protected as to her sides, but this is often the best position for the attack of her deck. Vessels are now generally constructed with armoured decks capable of resisting at 10° the fire that is a match for their side armour striking direct. Consequently, such a deck struck by projectiles glancing along it at angles more oblique than 10° to the deck plate should be stronger than the side armour, but if, from the heel over of a ship, or from the high command of the attacking battery, the shot strikes the deck more directly than 10°, the ship becomes more vulnerable to deck than side attack. The best authorities have at all times laid down that batteries placed high on land attack ships to greater purpose than those on the sea level. It may be questioned in many vessels whether projectiles would not generally explode or break in passing through an upper deck before they reach the armoured deck.

The attack of decks by approximately vertical fire is a separate question, and must not be confused with the plunging attack of gun-fire. This may be carried out by comparatively insignificant pieces of ordnance such as rifled mortars and howitzers, which can be easily and cheaply placed under cover of earthworks. Very striking results, as far as accuracy is concerned, have been obtained by the high angle fire of rifled ordnance experimentally,* but on service it could not be expected to succeed except against vessels at anchor, a position they may be compelled to take in water which is imperfectly cleared of submarine mines. Trials are necessary also to determine the effect of falling projectiles against deck plates. At Shoeburyness recent trials have been made with a 9-inch howitzer against 3-inch deck plates, which were perforated, or broken through, at 3000 yards range.

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* Krupp in 1879 marked out a space roughly representing the Inflexible deck on the range at Meppen; this was fired at by an 11-in. Howitzer at over 7000 yds. range. The first five shells fell close to the target, and the next five all struck it near the centre.

CHAPTER III.

ORDNANCE.*

Ordnance. THE progress of Arts and Sciences during the present reign has been reviewed in various publications brought out during the present year. These for the most part have been popular. It may be interesting, even in a work of more scientific character, to note a few features marking the progress that has been made in the development of Ordnance.

Improvement has been effected in three principal directions in guns: (1) in the material of which they are made, and in its disposition; (2) in the proportions and accuracy of fire of the piece; (3) in the actual increase of magnitude which has been given to ordnance by the use of the greatly improved mechanical means employed both in manufacture and in working guns on service.

As to material; in the commencement of the present reign, cast-iron was used for heavy guns, and bronze for light ordnance. All guns were cast, thus not only was the metal employed weak, but its application was such as failed to utilize fully such strength as it possessed, seeing that the metal in the immediate vicinity of the bore received the full shock, and transmitted it very imperfectly to the surrounding mass. For simple mechanical reasons, which are dealt with in any work on the construction of ordnance, comparatively little support was given by adding metal to the outside of a gun after a certain magnitude was reached, so that very large guns, on this account as well as for other reasons, were regarded as out of the question. The 68-pounder gun of 112 cwt., and 13-inch mortar of 5 tons, represented the heaviest ordnance, until the introduction of the Armstrong coil system in 1858 rendered greater achievements possible. The disposition of the fibre of metal so as to meet the

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* *List of Authorities.*—The *Engineer.* Some questions of detail have been referred to Elswick where Elswick matériel was concerned, and to the Departments in the Royal Arsenal for articles of Government manufacture. General Maitland's Paper *On the Treatment of Gun Steel,* read at the Institution of Civil Engineers, *The Reign of Victoria,* and the *Illustrated Naval and Military Magazine,* are also quoted.

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FIG. 1.
OLD TYPE 25 & NEW TYPE 26 TON GUNS
SHOWING PRESSURE & VELOCITY CURVES.

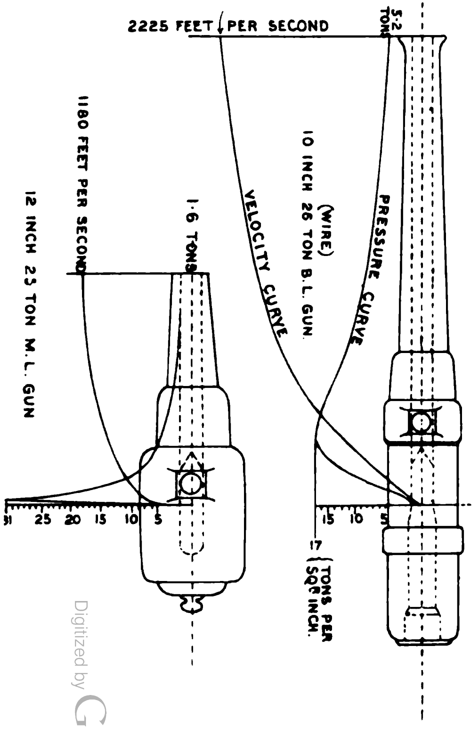
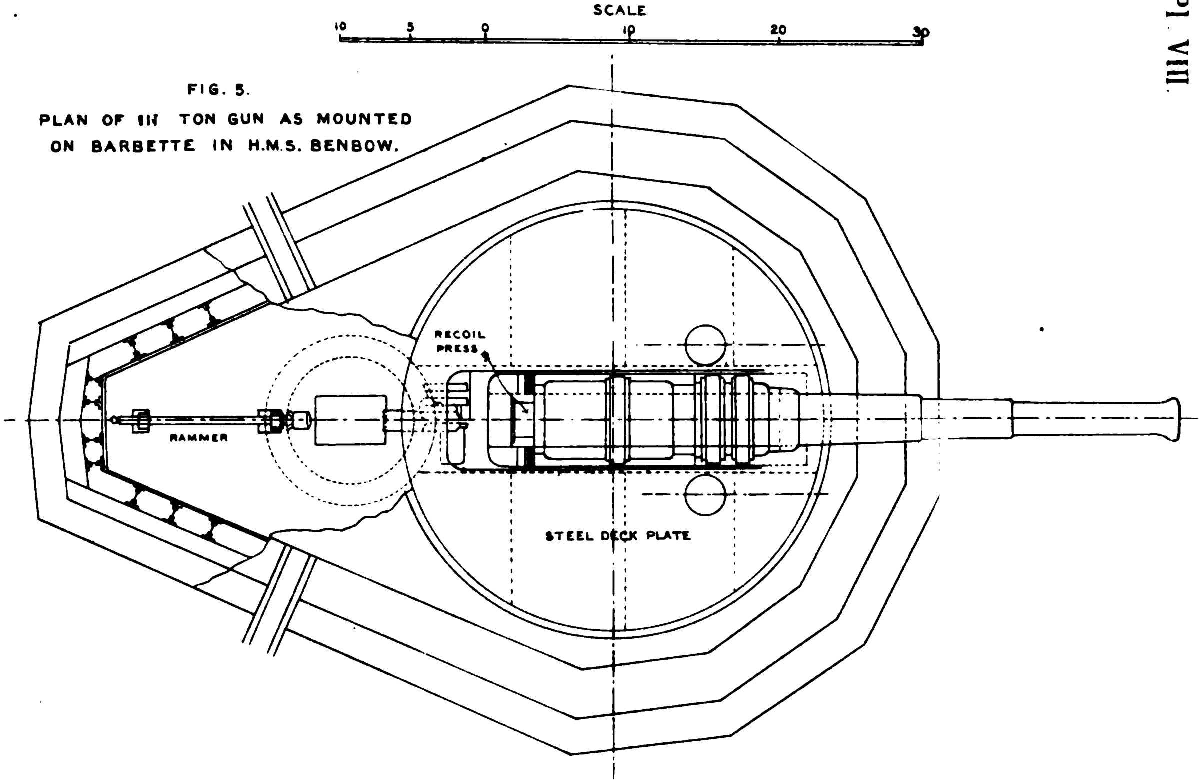


FIG. 5.
PLAN OF 111 TON GUN AS MOUNTED
ON BARBETTE IN H.M.S. BENBOW.



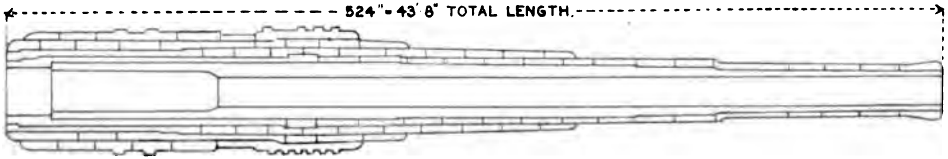


FIG. 4. THE NEW ELSWICK 16·25 in. 110½ TON B.L GUN.– SECTION

strain of discharge in its strongest direction, and the shrinkage of it so as to distribute the strain on outer and inner parts of the gun, are features now embodied in ordnance built up of steel hoops, as truly as in the coil system of wrought iron first introduced. The superiority in strength of a gun of the present time compared with one of 1837, therefore, is not measured merely by the fact that it is made of steel of a tenacity of 45 tons instead of cast-iron with only 10 tons tenacity at the most, because the metal has also the advantage of being so arranged as to enable every part to bear a share of the work.

The proportions of ordnance have been now established on series of investigations by means of pressure gauges in the bore. The powder has been improved by causing it to burn at first slowly, and to increase its rate of burning regularly as its combustion goes on, so as to start the projectile comparatively slowly and follow it up with pressure which gives a velocity of over 2000 feet per second at the muzzle, for the comparatively moderate pressure of 18 or 19 tons in the largest guns. How much may be effected in this way may be seen by a comparison between the early rifle-guns designed before these investigations had been carried out, and those now made.

Captain Andrew Noble, who took the lead in working out this question, has illustrated the progress in gun construction in Fig 1, Pl. VIII., which is taken from a paper of his. The diagrams represent the work which is got out of 25 tons embodied in an old-type gun and 25 tons in a wire Elswick gun. It will be seen that in the old piece, which is a 12-inch muzzle-loading gun, a velocity of 1180 feet is imparted to a projectile which weighed 615 lbs., at the cost of a maximum pressure of 31 tons per square inch. In the new gun, with a calibre of 10 inches, a velocity of 2225 feet is given to a projectile weighing 450 lbs., with a maximum pressure of only 17 tons per square inch. In the old gun, short as it is, the pressure has decreased to 1·6 ton at the muzzle, so that in it additional length would have been a mistake, whereas in the new gun there is at the end of a long bore still 5·2 tons' pressure, so that there would positively be more in favour of lengthening this gun than the other. The total stored-up work or muzzle energy in the old gun is 5939 foot-tons, and in the new 15,450 foot-tons. Hence out of 25 tons of metal is got more than 2½ times the work on the new system of slow powder and long bore than was obtained from 25 tons on the old system of quick-burning powder and short bore.

On Krupp's method of comparison—(*i.e.* the energy per ton of gun), the new wire gun has 617·8 foot-tons, and the old gun 237·0 foot-tons per ton of gun. It may be noticed that the old 12-inch gun taken in this comparison is inferior to the old pattern 12-inch gun now in the service, which, with the charge used, gives 7120 foot-tons energy.

Short guns and quick-burning powder came in as a false move. An old bronze gun mounted opposite to the gates of the Royal Arsenal, Woolwich, which was brought from Malta about the beginning of the century, has a bore of very nearly the length recommended at the present time.

As to accuracy, some estimate of the improvement effected may be formed by comparing the "probable rectangles" of old and new guns, that is, the spaces in which 50 per cent. of the projectiles may be expected to fall at any given range. For example: at a mile range the probable rectangles for the 18-pounder smooth bore, and the 12-pounder breech-loading rifled guns of the present day, are spaces respectively 121·7 yards long by 25·8 yards wide, and 20 yards long by 0·99 yard wide.

The increase in magnitude is perhaps the most striking difference between the British ordnance of the present time and that of 1837. The following statement is taken from the 'Reign of Victoria,' recently published.*

The great naval battles of England were won with comparatively light ordnance. The Victory at Trafalgar carried only 32-pounders and smaller guns. In 1837 some 42-pounders existed, but the regular armament of a 120-gun ship consisted of ninety-eight 32-pounders, four 18-pounders, two 68-pounder carronades, and sixteen 32-pounder carronades. It is interesting to compare such an armament with that of the new ships of the so-called Admiral class. One of these, the Benbow, carries two 111-ton guns and ten 6-inch guns. The Anson and two others mount four 67-ton guns and six 6-inch guns, besides fifteen "quick-firing" and ten machine-guns. It will be seen, then, that instead of a large number of comparatively light pieces we now have two or four of enormous power, supported by a secondary armament for quick light work. The introduction of armour has given ships complete protection against all the old-fashioned guns. At the time of the Crimean War in 1854, the largest vessels, such as the Duke of Wellington and the Royal Albert, carried two 68-pounder pivot guns of 95 cwt., and even these at 200 yards range were hardly a match for the 4½ inches

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* Contributed by the author to the portion of the work written by Lord Brassey. The figures were obtained from the officer in charge of H.M.S. Victory, and from reliable lists of armaments of 1837.

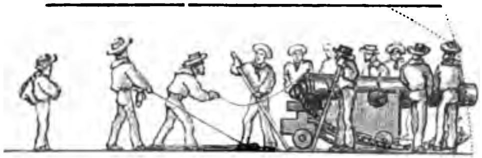
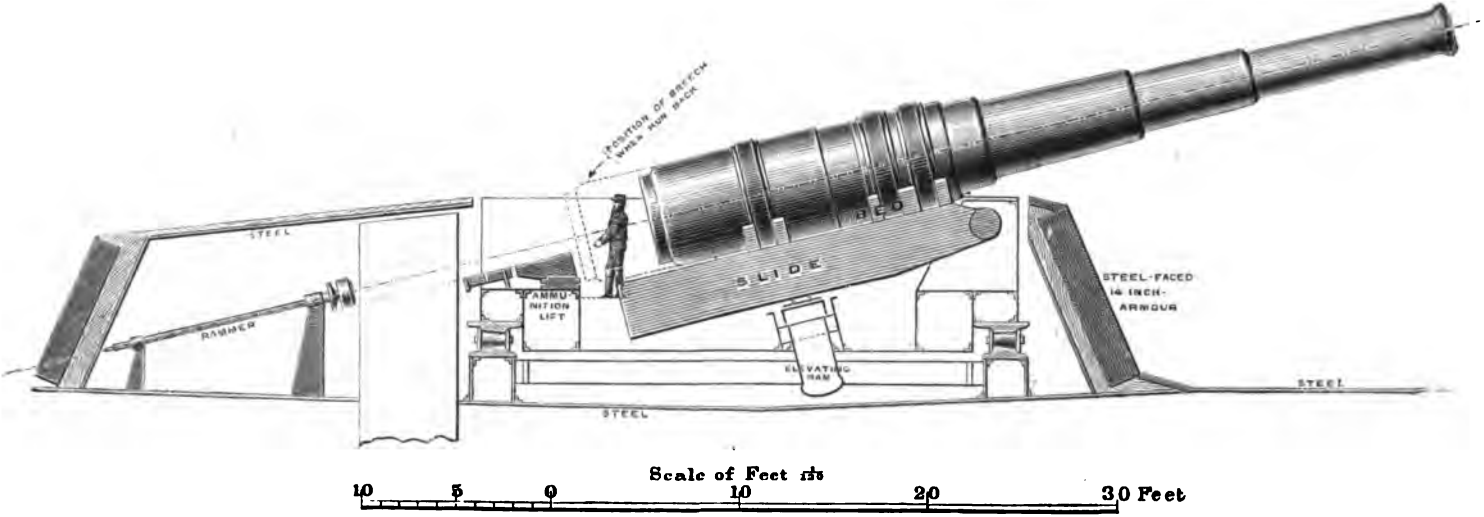


FIG. 2.



POSITION OF BREECH WHEN RUN BACK
STEEL
RAMMER
AMMUNITION LIFT
BED
SLIDE
ELEVATING RAM
STEEL
STEEL-FACED 14 INCH-ARMOUR
STEEL
Scale of Feet $\frac{1}{130}$
10 5 0 10 20 30 Feet

FIG. 3

FIG. 2. LARGEST SHIP'S GUN IN YEAR 1837. FIG. 3. 111-TON GUN OF BENBOW. BOTH GUNS DRAWN TO SCALE.

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of iron armour of the Warrior. Vessels now exist carrying as much as 22 inches of steel, while guns have increased in power in even a greater proportion than armour. The guns of the Benbow, Sanspareil, and Victoria, supplied from Elswick, are the most powerful in the world. They are "calculated to perforate about 35 inches of iron at the muzzle." The weight of metal projected by both broadsides of a first-rate man-of-war in 1837 was about 3856 lbs., while the guns of the Anson would throw 5600 lbs. of metal. The energy of both broadsides of the 120-gun ship would be about 67,034 foot-tons, while that of the Anson guns is about 162,360 foot-tons. A single projectile from one of the 111-ton guns, above mentioned, weighs 1800 lbs., and has about 57,580 foot-tons energy at the muzzle. The development here exhibited has been achieved by science and manufacturing power, which appear to us great, though no doubt they may soon be dwarfed by comparison with future achievements. It is no light task to control a gun over 40 feet long, in the act of delivering a blow of 60,000 foot-tons. This amount of energy applied in the form of an upward push would lift the entire vessel, weighing 10,000 tons, six feet into the air. By means of hydraulic buffers, the gun is brought to a stop with a recoil of five feet. The gun, the carriage, and lastly, the projectile, which is capable of passing through two or even three feet of solid iron, are each in their way remarkable.

Figs. 2 and 3, p. 441, show the largest ship's gun in 1837, namely the 42-pounder, weighing at most 84 cwt., and the 111-ton gun of the Benbow. Both guns are shown in working position and are drawn to the same scale, so that the increase in magnitude is seen at a glance.

The firing trial of the first new 111-ton breech-loading gun approved for H.M.'s ships Benbow, Victoria, and Sanspareil was commenced at the Woolwich proof butts on February 10th, 1887, under the direction of Colonel Maitland, the Superintendent of the Royal Gun Factories. A section showing the construction of this gun is given in Fig. 4, Pl. VIII.* The most important difference between this piece and the large breech-loading guns which immediately preceded it, such as the 105 and 100-ton guns supplied to Italy, is that the steel tube extends unbroken from end to end instead of being made in two lengths. There are also minor differences in detail, and the length is increased, being 43 ft. 8 in. in all.

The following figures are authoritative :—Length over all, 524 in.; length of bore, 487·5 in. (30 calibres). The breech engages in the breech-piece, leaving the "A," or inner tube with its full strength for tangential strain (*vide* Fig. 4), the "A" tube, being as above stated in a single piece instead of two lengths, as in the case of the Italia guns. It is supplied to Elswick from Whitworth's works, one of the few in England where such a tube could be made. There are four layers of metal hoops over the breech. Copper and bronze are used to give longitudinal strength. The obturation is a modification of the De Bange system proposed by Vavasseur. The maximum firing charge contemplated was about half the weight of the shot, *i.e.* 900 lbs., but depends upon the nature of powder used. The projectile weighs 1800 lbs. The estimated muzzle velocity is 2216 feet per second. The capacity of the chamber is 28,610 cubic inches, and that of the bore 112,595 cubic inches. The estimated total energy was 61,200 foot-tons, judging from the results with the 100-ton guns supplied to Italy.

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* This section is identical with that of the same gun given in *The Naval Annual* for 1886, but is repeated to make the description complete.

The gun was mounted on a proof carriage turned out by the Royal Carriage Department, under General Close. This carriage is made on bogies so as to run on rails passing easily round curves of 50 feet radius. The gun is fired on an inclined length of rails, the recoil presses of the carriage first receiving the shock and reducing the recoil. The carriage is made to lift into the Government barge so as to go easily to Shoeburyness or elsewhere. It can be altered so as to provide for turning, and it allows the piece to be fired at angles of elevation up to 24 deg. The cheeks of the carriage are made to open and close, so as to take the 12-inch gun as well as all larger pieces. The steel castings for it are supplied from the Stanners Close Steelworks.

Figs. 3 (p. 441) and 5, Pl. VIII., show the mounting of the 111-ton gun in the barbette towers of the Benbow. Figs. 6 and 7, Pl. IX., show a similar mounting applied to the turrets of the Victoria and Sanspareil. The gun is held down on the bed by steel bands, and recoils in its bed on the slide—*vide* Fig. 2, p. 441, and also Fig. 6, Pl. IX. The latter is hinged or pivoted in front, and is elevated by an elevating ram—shown in Fig. 2. When the slide is fully down the gun is in the loading position. The ammunition lift brings up the projectile and charge (which latter is subdivided like those employed in the German guns), in succession to the breech, the hydraulic rammer forcing them home. The simplicity of the arrangement is apparent. The recoil always acts parallel to the slide. This is much better than allowing its direction to be affected by elevation, and the distributed hold of the steel bands is preferable to the single attachment at trunnions. Theoretically the recoil is not so perfectly met as in some of the earlier Elswick designs, in which the presses were brought opposite to the trunnions, so that

Pl. IX.

FIG. 6. 110 TON GUN MOUNTED IN "VICTORIA" & "SANSPAREIL". ELEVATION.

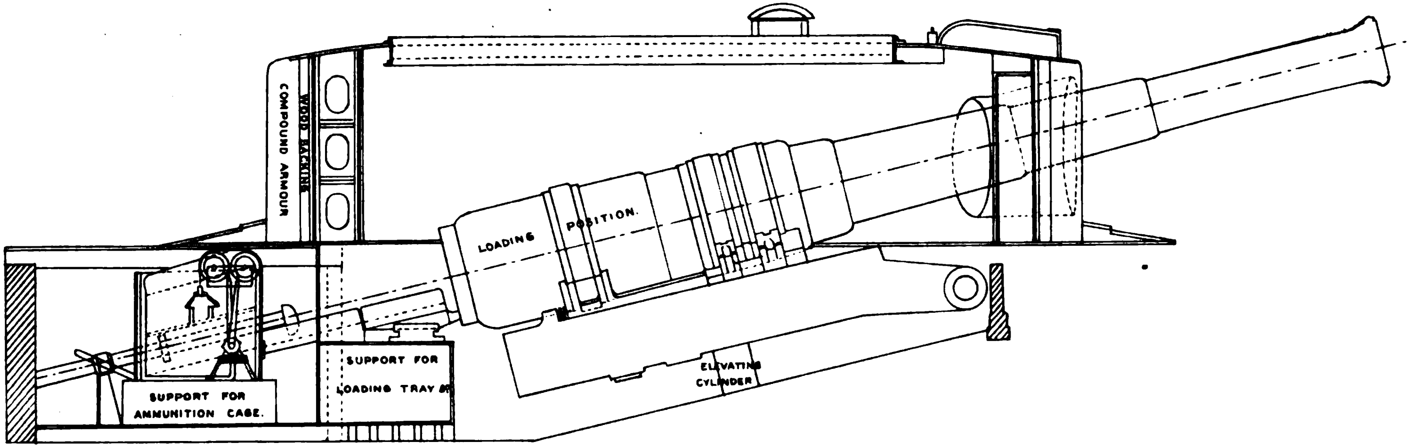
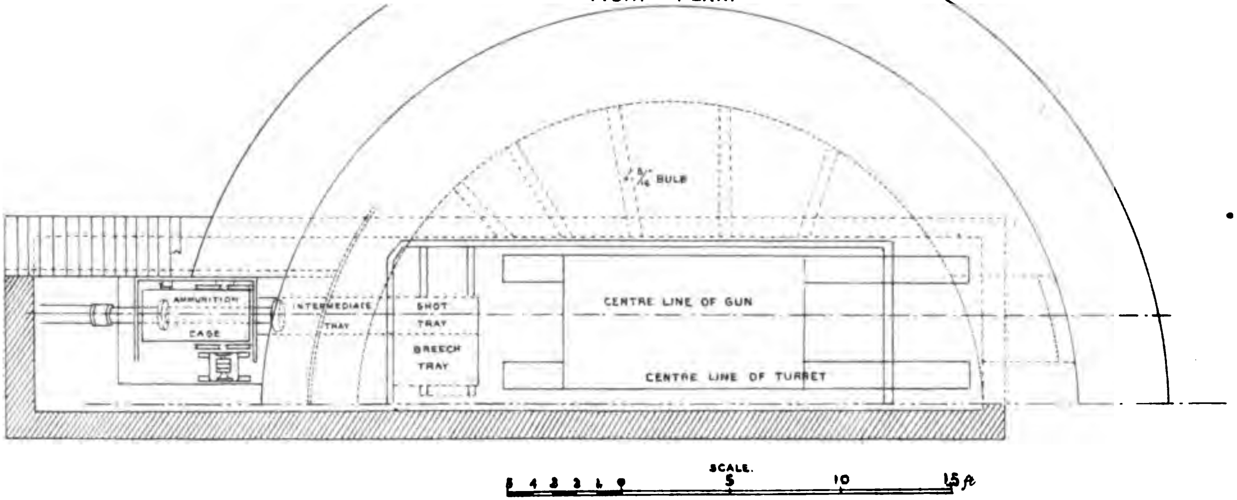


FIG. 7. PLAN.



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they acted symmetrically on each side of the centre of resistance. The barbette tower of the Benbow is covered by a steel plate, shown in Fig. 5, Pl. VIII., fitting close to the gun slide, so that the only opening is that behind the breech when the gun is in the forward position, and this is closed as it recoils. The only man of the detachment even partly exposed is the number one, while laying the gun, and in that position he is nearly covered by the gun and fittings.

The mounting for the 111-ton gun in a turret, as in the Victoria and Sanspareil, closely resembles this, as is shown in Figs. 6 and 7, Pl. IX. The turret is rotated and the gun itself run in and out by hydraulic gear, the operations of loading and working this gun are performed by the same means. The breech block is unscrewed from its seat in the gun, withdrawn, and carried to one side to make room for the operation of loading. The loading is performed by hydraulic lift and rammer, by which the projectile and charge are in succession brought up and entered in the bore, after which the breech block is replaced and screwed home.

Common shell, shrapnel shell, and steel armour-piercing projectiles, have been approved for the 111-ton gun. The common shell is shown in Fig. 8, Pl. X. Like the common shell for all the larger natures of new type guns, it is made of forged steel, and contains a bursting charge of 193 lbs. of powder, the total weight of the filled shell being 1800 lbs. The apex has a screw plug of larger diameter than that of the fuse, and is made removable to facilitate the insertion of the bursting charge. This is shown in Fig. 9. The fuse is a direct action one. The needle B is held in the centre of a copper disc C C, and is safe against explosion until it is actually brought into contact with an object, when it is forced down, igniting a patch of cap composition and the magazine at A, and so firing the bursting charge of the shell below. E E E are each priming charges of seven grains of pistol powder made up in shalloon bags to ensure the ignition of the bursting charge, which is in a bag of serge and shalloon beneath.

The use of this fuse involves the curious question of the physical conditions now existing in the discharge of our projectiles by slow-burning powder. The forward movement of the shell is now so gradual that the inertia of a pellet is only sufficient to shear a wire of one-tenth the strength of that which might formerly have been sheared by a similar pellet in an old-type gun with quick-burning powder; consequently, in many cases, it is found better not to depend on a suspending wire thus sheared, but to adopt direct action. The fuse in question would act even on graze, at any angle over

10 deg. Probably at less angles than 10 deg. it would not explode against water, which would be an advantage in firing at ships.

Shells so gently put in motion, and having no windage, might be made, it might naturally be supposed, singularly thin. The adoption of steel in place of iron, however, is because it has been found that common shells break up against masonry instead of penetrating it when fired from these large high-velocity guns.

The shrapnel shell is shown at Fig. 10, Pl. X. Like the common shell, it is made of steel, and is of the usual form of the pattern of General Boxer, with wooden head, central tube, and bursting charge at the base. It contains 2300 four-ounce sand shots and an 8 lb. bursting charge. It weighs 1800 lbs. The fuse is time and percussion; it is shown in Figs. 11 and 12. It closely resembles the original Armstrong time and percussion pattern. The action is as follows:—The ignition pellet A, which is ordinarily held by a safety pin, is, after the withdrawal of the latter, only held by a fine suspending wire, which is sheared by the inertia of the pellet on discharge, a needle lighting a percussion patch of composition and the composition ring B B. This ring burns round at a given rate until it reaches the communication passage C, when it flashes through the percussion pellet E and ignites the magazine D, and so ignites the primer shown in Fig. 12, flashes down the central tube of the shell, and explodes the bursting charge in the base—Fig. 10. The length of time during which the fuse burns, depends on how far the composition ring is turned round, and what length it consequently has to burn before it reaches the communication passage C. If the fuse should be set too long, or from any other cause the shell strikes before the fuse fires the charge, the percussion action fires the shell on graze by the following arrangement:—The heavy metal piece containing the magazine D constitutes a striker, which is held in place by a plain ball G near the axis of the fuse and by a safety pellet H. On first movement in the gun, this latter by inertia shears a suspending wire and leaves the ball free to escape above it, which it does by centrifugal force, leaving the magazine striker D free to fire itself by momentum on the needle shown above it on impact. There is a second safety arrangement, not shown in the figure, consisting of a cross pin, held by a weak spiral spring, which is compressed by centrifugal force during flight, leaving the magazine pellet free to act, as above described, on impact.

The armour-piercing projectile is shown in Fig. 13. It is to be made of forged steel, and supplied by Elswick. In appearance it very closely resembles those fired from the 100-ton gun at Spezia, shown in Pl. XIV. of *The Naval Annual* for 1886.

Pl. X.

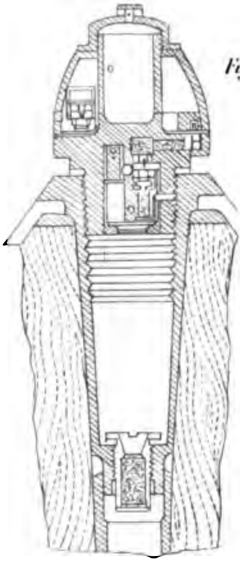
Fig. 12.

FIG. 12. TIME FUZE FOR SHELL FOR 111 TON GUN

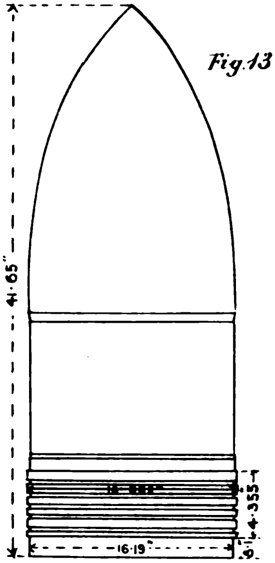
Fig. 13.

FIG. 13. ARMOUR PIERCING STEEL SHELL FOR 111. TON GUN.

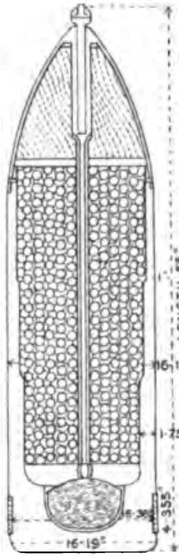
Fig. 10.

FIG. 10. SHRAPNEL FOR 111 TON GUN.

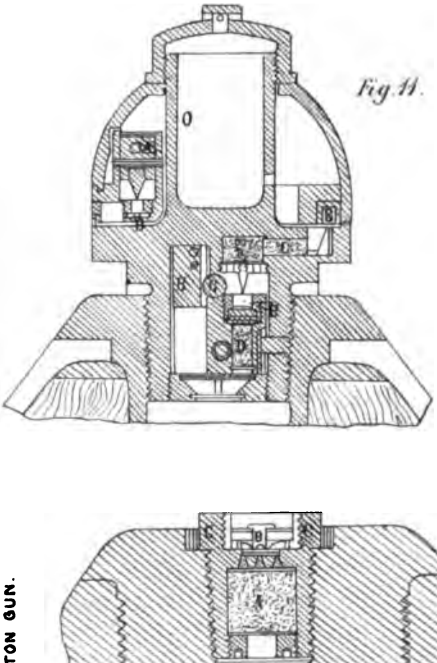
Fig. 11.

FIG. 11. TIME FUZE FOR SHELL FOR 111 TON GUN.

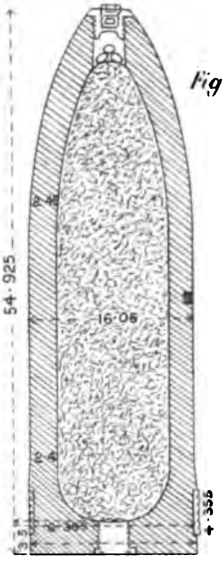
Fig. 8.

FIG. 8. COMMON SHELL FOR 111 TON GUN.

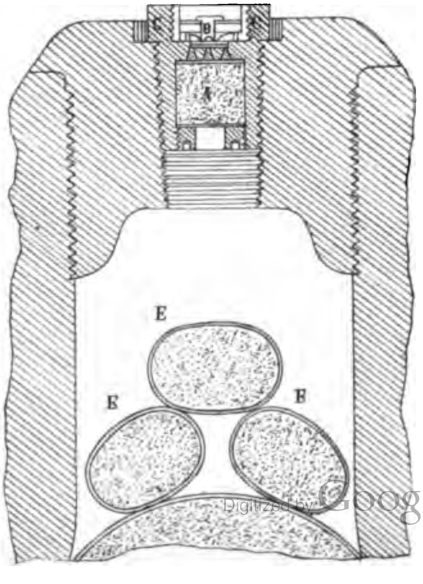
Fig. 9.

FIG. 9. FUZE OF COMMON SHELL FOR 111 TON GUN.

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The following results were obtained in the proof in the Royal Arsenal :—

Date.	Charge of Powder.	Muzzle Velocity.	Average Pressure.	Muzzle Energy.
	lbs.	feet-secs.	tons per sq. in.	
Feb. 10th	600*	1,699	9·65	36,040
„	700*	1,843	12·05	42,390
„	800†	2,007	15·1	50,270
Feb. 16th	850†	2,078	18·0	53,920
March 3rd	850†	2,142	19·5	57,320
„	960*	2,104	15·7	55,250
„	850†	2,149	19·9	57,630

* Waltham Abbey brown prism, No. 1.
† Westphalian brown prism.

It is natural to compare these results with those obtained from Krupp's 119-ton gun. As seen in the above Table, at the Royal Arsenal the muzzle energy obtained with 850 lbs. of German powder, and a pressure of 19·9 tons, was 57,630 foot-tons, the velocity being, as above mentioned, 2149 feet. A still larger amount was estimated for this gun, as noticed above, and there appears to be every reason to say that more might be got, seeing that the pressure is not high, and might be much increased without injuring the gun. Krupp's 119-ton gun on one occasion gave an energy 50,780, with a projectile of 846·6 lbs. and a velocity of nearly 1900 feet per second. This is the highest * Krupp record published. It is 6850 foot-tons less than the Elswick gun. The results could be better compared if the pressure in Krupp's gun was given. Probably, however, the pressure is kept well down. The natural tendency to rivalry in gunmakers is modified by the reflection that a mishap would be very damaging. The pressures adhered to are so reasonable, that surprise may be felt that the guns are not taxed rather more. The old-type guns were habitually subjected to higher pressures. Probably, however, it is wise to keep well on the safe side at present. We now employ a very large charge, which is made to act in a manner which is admirably suited to the circumstances of the case. The powder burns slowly, and keeps up the pressure as noticed above. We are dealing with an enormous force, which is acting as if subject to scientific control. It may be even questioned whether circumstances might not arise which might cause the powder to behave differently, and then we might have to reckon with a very different rate of increase from what could take place in old days. Quick burning powder was force in a bad shape, but its very bad action gave the guarantee that it could hardly surprise us by behaving worse. It appears, indeed, to be very difficult to make cocoa powder burn rapidly, but it might be well to make experiments with it in various conditions, such as after being broken, exposed to dry heat, and the like.

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* A higher number is given in *Nature*, but it appears to be an error, being quoted from the *Revue D'Artillerie* for January 1887, p. 323, which gives "18,000 atm." This is apparently a misprint for "18,000 tm," an amount which is not supported by the velocity and weight given, viz., 579 m and 920 kg. These imply an energy of 50,780 foot-tons, which exactly accords with that obtained indirectly from Krupp through American sources.

The proportions of the gun form the principal feature of new type guns, but immediately connected with this question is that of proportion and weight of projectiles. This deserves notice the more, because Armstrong and Krupp obtain their energies in different ways. The energy being made up of the weight of projectile multiplied by the square of the velocity may depend on weight and velocity in varying proportions. Thus, in the Elswick 111-ton gun the projectile is much lighter and the velocity higher than in Krupp's 119-ton gun. The weight, diameter, and expression $\frac{W}{D^3}$ which expresses the power to keep up velocity, is in each gun respectively 1800 lbs., 16·25 and 0·42, and 2028, 15·75 and 0·52, the velocities being 2149 and 1900. The Elswick projectile has a great advantage at short ranges—that of Krupp at long ones. The long heavy projectile has more power to overcome resistance, and also owing to the velocity being less the resistance is less. The Elswick gun shows the best ballistic result; but if it be asked how it comes that Krupp perseveres in his system, the answer is that probably both Krupp and Armstrong are right, for their guns are meant for different purposes. The 111-ton gun is for the Navy; the number of rounds carried is necessarily limited on board ship—in fact, lamentably small—and thus decrease in weight is a great object. Krupp's gun has hitherto been used for coast defence, when long range may be an advantage and weight a secondary question. In short, for Britain, for issue to ships, the light projectile and higher velocity is the best combination; while the greater weight and lower velocity may be best, being intended for continental coast armaments.

The BALLISTIC POWERS taken from the RESULTS hitherto obtained with the PROJECTILES of the heaviest representative ENGLISH and GERMAN B.L. GUNS are as follows:—

	Weight of Gun.	WEIGHT OF		Diameter of Shot.	$\frac{W}{D^3}$	V	E
		Shot.	Charge.				
	Tons.	lbs.	lbs.	in.		foot-secs.	foot-tons.
Krupp	119	2028·25	846·6	15·75	0·519	2,000	50,780
Elswick	111	1800·0	850·0	16·25	0·420	2,148	57,580
Royal Gun Factory . .	67	1250·0	630·0	13·5	0·510	2,025	35,560

The powers of the Krupp and Elswick guns are thus brought more nearly equal than shown on Plates XV. and XVIII. and the Tables of Ordnance of *The Naval Annual* for 1886.

Maitland on gun-steel.

On March 15th, 1887, General Maitland, C.B., then Superintendent of the Gun Factories, Royal Arsenal, read a paper at the Institution of Civil Engineers on 'The Treatment of Gun Steel'* obtained from Messrs. Cammell & Co., Firth & Sons, Vickers, Sons & Co., Sir J. Whitworth & Co., and from the Royal Gun Factories. The steel contemplated generally breaks at about 30 tons in the soft or annealed state, and at 45 tons per square inch when hardened in oil. It contains from 0·25 to 0·5 per cent. of carbon, and from 0·5 to 0·8 per cent. of manganese. The author held that taking the breaking strain after oil hardening as the datum, the limit of elasticity in the unhardened state rises with the proportion of manganese, and the effect of hardening in oil increases with the proportion of carbon. raising both the elastic limit and breaking strain more than with the steel with the higher proportion of manganese. The qualities of steel-forgings oil-hardened in mass lie about midway between those of hardened and unhardened test pieces. As to the effect of the conditions under which metal is tested, the author noticed that if the copper cylinder in a crusher gauge be repeatedly subjected to the same pressure slowly applied, no change is produced after the first trial, but if blows be repeated, each blow produces further compression. In a gun such a gauge used for several rounds, simply records the highest pressure occurring in the series. If, however, an unsuitable charge be employed, setting up wave action, the gauge will register a higher pressure than that due to any single round, showing an analogy between the actions in guns and testing machines.

On the other hand, the short fracture produced, even in the best metal, when a gun bursts is peculiar to itself. General Maitland tried to reproduce this effect in testing machines, when he found that sudden tension brought on an ordinary test piece by the check of its upper end, when falling, caused 47 per cent. elongation before fracture in metal which only elongated 27 per cent. when slowly acted upon. The explanation offered is that in sudden strain, time is insufficient to enable the weakest place to be discovered before the whole is stretched. The same result followed when cylindrical test pieces with large ends were torn asunder by the explosion of an annular charge placed round the decreased centre portion, the whole being laid in a tube open at both ends, and the charge fired so as to cause fracture, and project the enlarged ends in opposite directions. The elongation now rose from 47 to about 62 per cent. By means of a plunger acting suddenly on water in a tube, a "short" fracture resembling that of ruptured ordnance was produced when the tube was split.

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* For this Paper the Telford Medal was awarded.

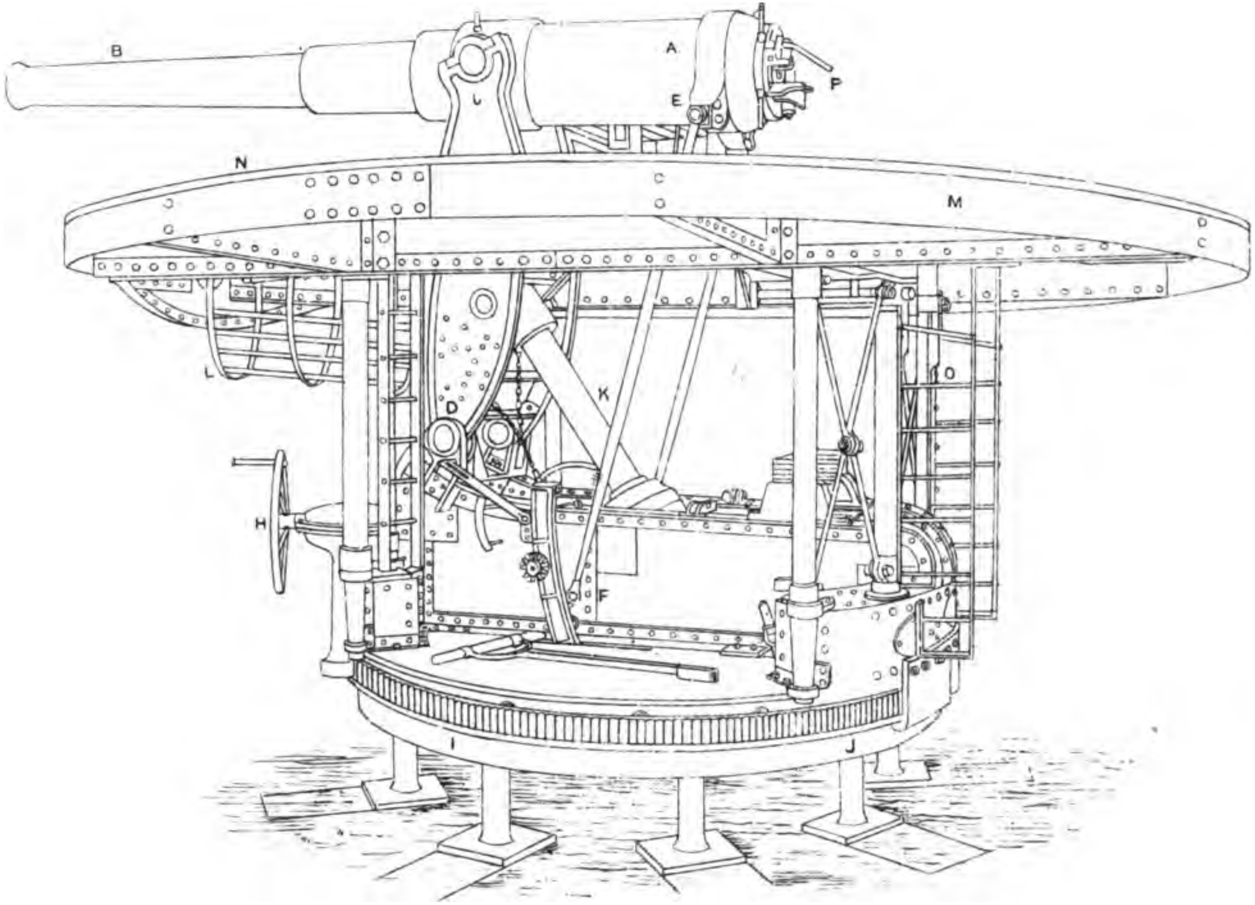
Passing on to chemical quality and uniformity, General Maitland showed that in an ingot, the sides which cool first have most nearly the true or average proportion of carbon; the centre near the bottom has least carbon, the top most. Erosion in the bore of a gun is best borne by metal which has been forged thoroughly. The forging necessary to double the length of any bar is taken as a unit. The action of forging determined a decided grain in the metal, so that it was even found possible to develop grain in any direction. It is desirable to forge the various portions of a gun, so as to bring the grain into the best direction. Hoops are forged on successive mandrils of increasing size on this principle. The action of internal strains and the treatment of the metal with a view to their development for beneficial effects, and also their removal by annealing at St. Etienne and St. Chamond, was dealt with; also the system of alternate hardening and annealing, pursued at the Terre Noire Works, which produces somewhat the same effect as forging. A formula employed for shrinkage at Woolwich was finally given.

Pl. XI. shows the 6-in. breech-loading gun mounted on a hydro-pneumatic disappearing carriage. The gun A B rests on the extremities of levers C D, under the trunnions, and E F under the breech-pivoting at C and E on the gun, and D and F on the lower carriage. At K is a recoil press, which has two chambers. The recoil of the gun is absorbed by driving fluid from the recoil chambers through a valve into an air chamber, compressing the air on the same hydro-pneumatic principle as in the Moncrieff system, the gun descending and disappearing behind the parapet or wall of the pit in which it is mounted, indicated by the circular frame in Pl. XI. After loading, the opening of a valve causes the compressed air to drive back the fluid and raise the gun into the firing position, as shown in Pl. XI. This system of protection, which has been shown to be very complete, as in the case of the Hercules' trials, has been adopted for coast defence, especially in our Australian colonies. This system of mounting is now being applied to guns of 70-tons weight at Elswick. The Moncrieff system applied to Russian ships was shown in 'Annual' for 1886, pp. 360, 361.

Gun Carriages and Mountings.

There is little to notice in the way of change in carriages and mountings. The principal new feature is a special mechanism for withdrawing and pushing home the breech block of naval guns termed

Pl. XI.



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Gun Carriages and Mountings.

a "controlled carrier." This consists in the application of a winch and quick screw for opening and closing the breech, instead of allowing it to swing on its hinge like a door. The inconvenience of a loose swinging piece of this nature in a sea-service mounting, is obvious. The screw movement is simple and very easy to work, and although the breech looks complicated, owing to the number of pieces, the fittings are themselves simple. The arrangement is applied to the new 9·2-inch guns for H.M.S. Impérieuse.

American Dynamite Gun.

The dynamite gun is an engine for projecting shells or cases full of dynamite at distant objects by means of compressed air, by which the danger of premature explosion is avoided. It has been brought into its present shape chiefly by Lieut. E. L. Zalinski, of the U.S. Artillery. Its powers have been exhibited as a harbour defender in projecting torpedoes at ships. An 8-inch dynamite gun was mounted at Fort Lafayette, New York Harbour, in August, 1885. It is 60 feet long, its barrel consisting of four lengths of ¾-inch wrought-iron tubing, lined with ⅛-inch brass. On September 20th, 1887, a trial of the gun took place in the presence of American and other officers, Major Bainbridge, R.A., representing England. An old schooner, the Silliman, was anchored stern on to the gun at 2000 yards range; five rounds were fired—three with uncharged shells, which fell close to the ship, and two with charges of 55 lbs. each of blasting gelatine, which destroyed the vessel; a sixth round scattered the broken parts.

The gun has been very favourably reported on. It would be an alternative means of defending a harbour, to fixed and locomotive torpedoes, offering some very marked advantages. The drawbacks are—1st, the time of flight, which is so considerable that it would interfere with its action on ships in motion; 2nd, the great size of the gun, which needs protection more fully than ordinary guns, as it would be destroyed by light quick-firing pieces; lastly, it needs to be developed to command a long range, such as possessed by artillery, when its slow flight tells more and more against it.

CHAPTER IV.

Quick-firing Guns and Small Arms.*

During the past year great strides have been made in the development of quick fire by Sir W. Armstrong and Co.

The term quick or rapid-fire gun was devised to describe a gun of small calibre, the projectile and powder for which are combined together in a metallic cartridge case, the loading consequently being rapidly performed, and the rate of fire considerably increased. The original 6-pounder rapid-fire gun was intended for use either on board ship or on a boat, and the conditions were that it should be able to fire twelve rounds a minute, the gun being destined chiefly for use against torpedo boat attack. Of late the use of metallic cartridge cases and simultaneous loading has been extended by Sir W. Armstrong and Co. to guns of considerable shell power and penetration, thereby largely increasing the area which can be effectively defended by guns of the limited capacity of the 6-pounder.

It is obvious that if a considerably increased rate of fire can be obtained from a weapon firing a 30-lb., 40-lb., or even heavier projectile, a great addition has been made to the value of the smaller calibre guns on board ship, whether for defence against torpedo boats or for the attack of unarmoured or thinly armoured structures.

Considerable improvements had been effected at Elswick in the mountings of the smaller rapid-fire gun, and this success suggested the possibility of extending the principle to heavier guns. The Elswick automatic recoil mounting for the 3-pounder Hotchkiss rapid-fire gun has been, in fact, the germ from which a 30-pounder and a 70-pounder mounting have arisen. The following account of this mounting will enable its action to be understood. The gun itself is placed on a rocking slide, which pivots on trunnion bearings, the gun only moving backwards and forwards on the slide. The elevation and depression are given by rotating the slide round its trunnions, by means of a shoulder piece attached to it. A clamping arc is fitted to the right side, so as to fix the gun at an angle of elevation required. In front of the trunnion bearings are screwed two piston rods, which pass through glands into the recoil presses, forming part of the revolving bracket. The bore of the recoil press, from being made slightly conical, allows a free passage of water past the piston at the commencement of the recoil, such passage being gradually diminished towards its end. At the rear of the trunnion bearings are two springs contained in boxes, which also form part of the rocking slide; these being compressed during recoil, serve to return the gun immediately to the firing position. The rocking slide is provided with trunnions, which fit into a revolving bracket, on which the gun is trained horizontally by means of the shoulder piece. This revolving bracket is carried on a pivot plate, to which it is attached by a clip ring in halves. A clamp fixes the bracket in any position. A gun-metal pivot at the centre of the mounting takes the weight of the mounting, and reduces the friction when training. This bracket carries a thin steel shield for protection against rifle fire. Since the gun always recoils in the line of fire, the strains of recoil never vary. From the pressures indicated in the recoil presses during experiment, the maximum strain was found to be 6·7 tons, and the mean strain 4·75 tons, the total amount of recoil being 4 in. Assuming the powder pressure to be 15 tons per square inch, a strain of 40 tons per square inch would be given off on the stand at the centre of the gun in the case of the non-recoil mounting, so that it is seen how much the mounting is relieved by the adoption of a certain though small recoil. As the gun is allowed to recoil, a guard is fitted over the trigger in the pistol to prevent the use of the trigger for firing. A lanyard is attached to it and led through the brass guard in rear, to enable a man at the shoulder piece to fire by pulling the lanyard. A knot is made in the lanyard, so that the gun cannot be fired if it does not return into the firing position. A rate of fire of about twenty rounds a minute has been obtained with this gun.

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* *Authorities.*—The cuts and descriptions of quick-firing guns are taken from the *Engineer.* Those of magazine rifles from Major-General Wardell's description in *Engineering.*

Colonel Arbuthnot's Paper, U.S. Institution Proceedings.

Captain James' Paper, U.S. Institution Proceedings.

Report and Minutes of Evidence on cutlasses and cutlass-sword-bayonets supplied to the Royal Navy, together with War Office Minutes on the subject: February 15 to March 17, 1887.

30-pr. rapid-fire gun.

The 30-pounder rapid-fire breech-loading gun, calibre 4·724 in., or 12 cm., fires a shell of 30 lbs. weight with 9 lbs. of powder. It is shown in Fig. 1, Pl. XII. The gun is entirely of steel, its total length is 14 ft. 2½ in., the length of bore 35 calibres, and the weight 34 cwt. This gun does not exhibit the feature specially noticed above, namely, the rocking slide, which is, however, embodied in a later pattern, but it has other good points. The breech is closed on the interrupted screw system, the breech block being formed on two steps, both of which have portions of an interrupted screw on their surfaces, the threads on one step standing opposite to the blank spaces on the other. This arrangement distributes better the strain on the block, and makes the opening and closing more rapid. The breech block swings into place, and is secured by a small turning movement. This may be well seen in Fig. 1, Pl. XII., which shows the breech open (Fig. 2 shows it closed). The gun is fired by electricity, the mechanism for that purpose being simple and ingenious. In the base of the cartridge case is screwed an electric primer, against which a brass pin carried in the axis of the breech block presses. The pin is in communication with the electric wires, which carry the current to fire the primer, only when the breech block is closed, and secured by turning the lever downwards against the rear of the block (*vide* Fig. 2). In this manner all danger of accidental discharge is avoided, and complete security gained. The mounting consists of an under-carriage or slide I in Fig. 1, carried on four rollers, and working round a central pivot. To the front is attached a shield to protect the gunners. The training is effected by moving a wheel and shaft H K acting on a pinion on the left of the carriage, working in a rack on the bed-plate. Elevating is performed by a similar wheel G working a rack, pinion, and worm, also on the left of the carriage. The shafts which actuate the training and elevating gear are both brought well to the rear, and close to the wooden shoulder-piece against which the firer presses, so that he has everything close to his hand. The carriage proper works on top of the slide, the recoil being checked by means of a hydraulic Vavasseur buffer F. The running out is automatic after each round. This gun has been most successfully tried at the Government ranges, a rate of fire of eight to ten rounds per minute being obtainable.

Fig. 3, Pl. XIII., shows the newest pattern quick-firing gun in which the "rocking slide" noticed above is embodied. Here the gun A and recoil C cylinder move together. The breech open is seen at B. The shoulder piece D enables the piece to be fired like a small-arm, the recoil being absorbed independently. The eight rounds of ammunition at E and eight rounds on the other side of the piece travel with it. F is the steel shield.

70-pr. rapid-fire gun. Designs for a 70-pounder rapid-fire gun have been completed, in which in the main the arrangements adopted for the improved 30-pounder with the rocking slide have been followed. Should this gun give good results, it is thought possible that rapid-fire guns may

30-POUNDER RAPID FIRING GUN.

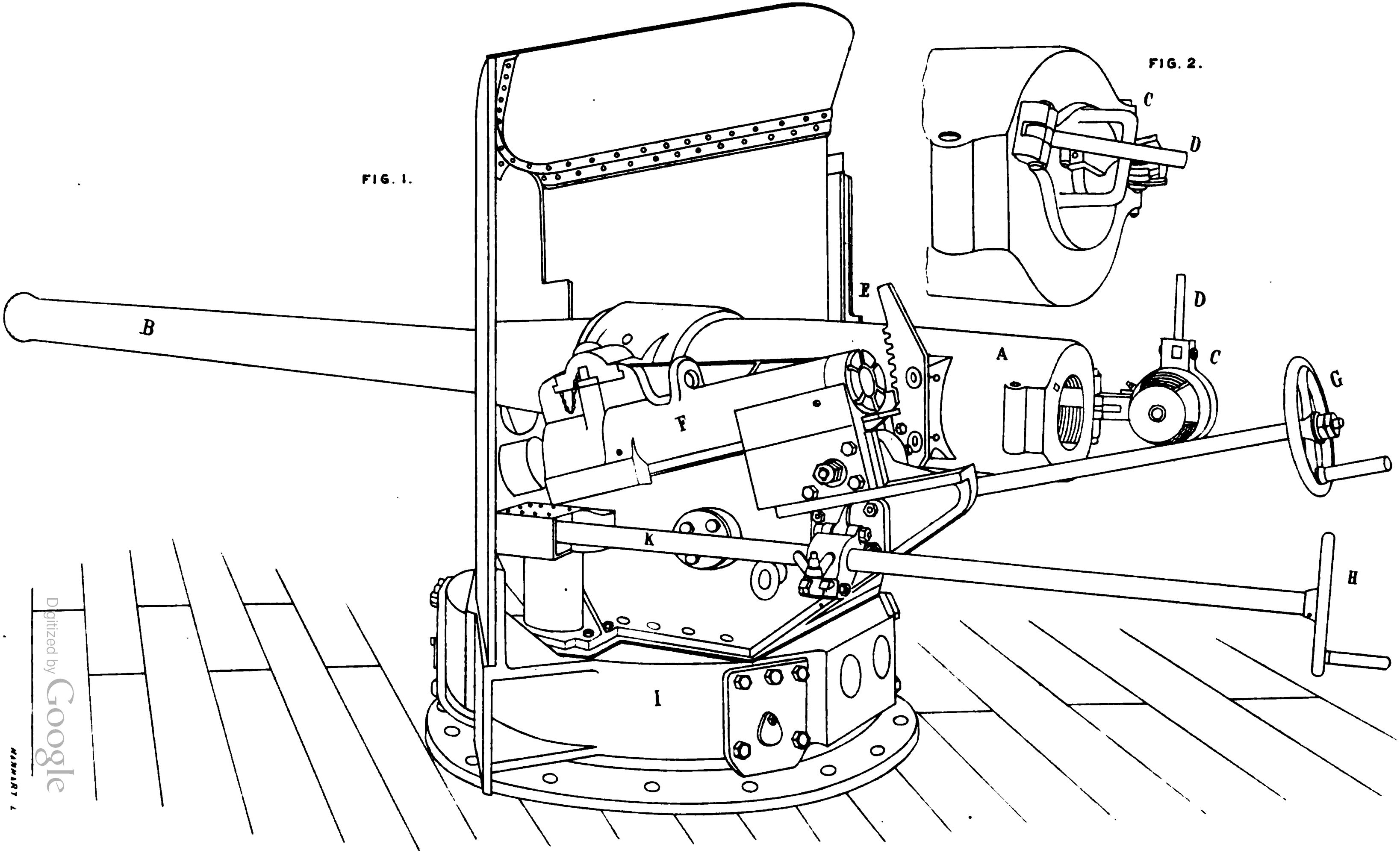

FIG. 1.

FIG. 2.

Pl XII.

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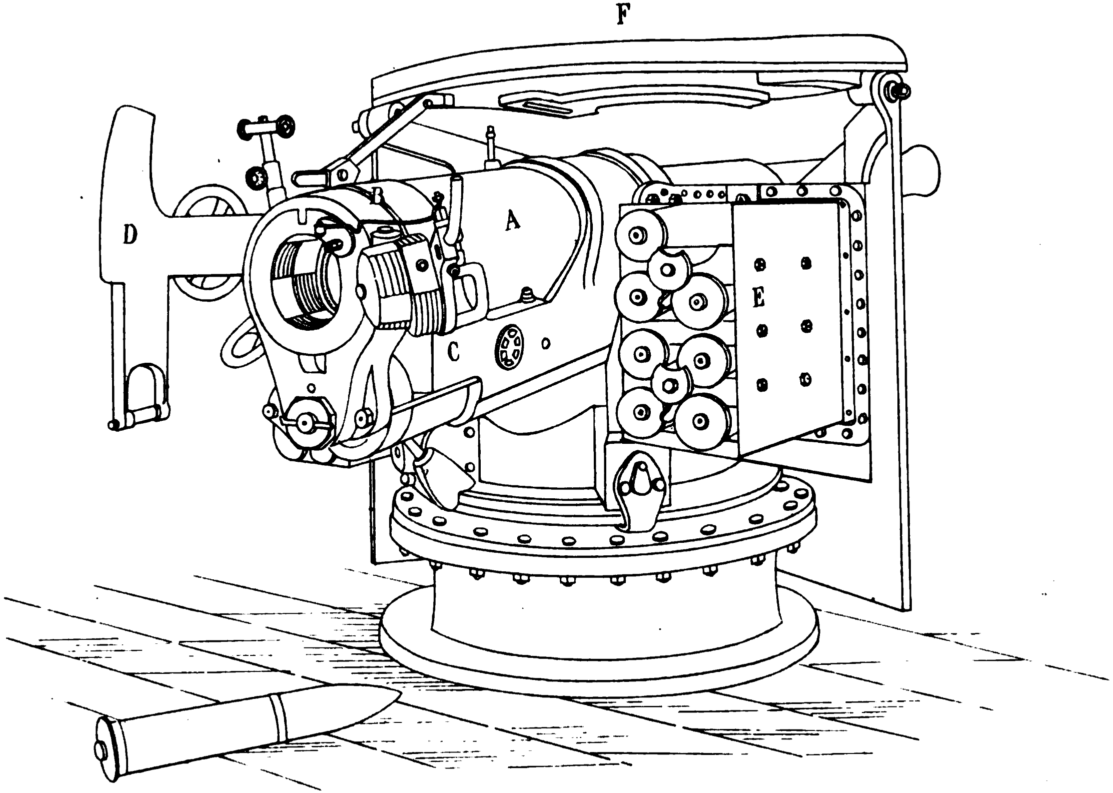
Pl XIII.

FIG. 3.
30-POUNDER RAPID FIRING GUN
WITH ROCKING SLIDE.



HANHART, LITH.

replace on board ship all the lighter artillery, whether forming the main armament of small vessels or the auxiliary armament of large ironclads. There is a 3-pounder quick-firing gun on a non-recoil carriage, in which the gun has no movement or recoil. The carriage with its mounting, probably in virtue of its elasticity, absorbs much of the shock, and enables the gun to bear the strain, which is, however, much more satisfactorily dealt with in the recoil mounting. Hotchkiss guns have been manufactured at Elswick in large numbers, especially for the British Government. They are used extensively on board ships and in torpedo boats.

Nordenfelt rapid-fire guns.

During the year Nordenfelt has made a marked advance in the development of his quick-firing guns, and has certain designs now awaiting trial by the British and other Governments. These may probably be given at a future time. Speaking generally, Nordenfelt considers that the manipulation and laying of the larger quick-firing guns will seriously limit their rate of firing on service, and that the true direction for development is to make a smaller piece with a bore and projectile of such proportions as to give the same power of perforation as the larger shell, coupled with a reasonable, though no doubt smaller, explosive power. Thus, instead of a 40 or 70-pounder rapid-fire gun, Nordenfelt recommends a 14-pounder with a 3-inch bore, giving a length of travel of shot of 35·5 calibres, the total length of the piece being 138 inches. This gun compares well as to range and perforation with larger pieces. Its muzzle velocity is given in Nordenfelt's last pamphlet as 2120 feet seconds, but we believe that this has been now exceeded. The factor affecting perforation and power to keep up velocity, namely $\frac{W}{D^3}$, is 0·519, which is very large. The comparative value of the gun he thus advocates, and of the larger pieces made at Elswick, is a matter which must be decided in actual trial. Nordenfelt, however, proposes to utilise the 40-pounder, and smaller B.L. guns now in the service, to the fullest extent by an alteration in the breech, which will convert them into quick-fire guns by the application of the direct motion of swinging home the breech-piece, which has been noticed under the head of the 30-pounder rapid-fire Elswick gun.

Small arms.

Small Arms.—The rifle at present in the hands of our men, the Martini-Henry, has for some time past ceased to be what it professed to be at its introduction, namely, the best small arm extant. Colonel Arbuthnot, then Superintendent of Enfield Factory, read a paper at the United Service Institution on June 16th, 1886, from which the facts of the case may be taken.

Colonel Arbuthnot's Paper.

The first issue of the Martini-Henry rifle to our troops was made in 1874. This arm superseded the converted Snider Enfield. The breech action was much better than that of the converted arm, while the diameter of the bore was reduced from 0·577 to 0·45 in., owing to which its shooting powers were greatly in advance of those of the Snider. In 1879 it was found in the course of some siege operations conducted at Lydd, that while the Martini-Henry bullet kept up its velocity so well as to be superior to all others at 500 yards range and over, the trajectory at shorter ranges was appreciably less flat than that of lighter bullets projected with a higher velocity. This led to the conclusion that a reduction of bore to 0·40 in. was advisable, and a pattern was recommended in which this was embodied in conjunction with a quick twist of one turn in 15 in., the ratchet form of groove and a compound wad ¼ in. thick of beeswax and cardboard. Magazine arms, however, were coming in abroad, which enable a certain limited number of rounds to be discharged at any desired moment with much greater rapidity than is possible with a single loader, and there was a strong wish for them in this country. This was resisted by some authorities on the ground that for numbers of rounds beyond the provision of the magazine, the single loader fires even a greater number than the magazine arm, with its magazine in use. The question of the magazine arm was then for the moment deferred. A device termed "a quick loader" was at this time contemplated, by which 6 cartridges were successively pressed up by a spring and presented so conveniently for loading that 6 rounds could be fired in 26 seconds instead of 40 seconds, when the rounds were taken from the pouch in the ordinary manner. The other accompaniments of this arm, which was termed the "Enfield-Martini," were as follows: a safety bolt, also a narrower stock, with a butt-plate set on at a more acute angle so as to give the effect of a greater bend in the stock. The barrel rested on the fore end without being let into a groove, and a wooden hand-guard was supplied to furnish a grasp when the barrel should be hot. A solid drawn cartridge with a charge of 85 grains of powder was adopted. A new pattern of sword bayonet was approved; it was fixed under the barrel instead of on one side of it.

Magazine arms. Captain James' Paper.

Magazine Arms.—It was, however, impossible that the question of magazine arms could be long deferred. On February 24th, 1886, Captain W. H. James, late R.E., read a paper on Magazine and Repeating Arms in the United Service Institution, at the request of the Council. He then pointed out that the power of suddenly intensifying rifle fire at any critical moment has been recognised as so important an advantage that it may decide a victory; consequently all the European nations are adopting magazine arms even at the cost of considerable outlay and complication. Captain James also dwelt on the confidence imparted to a soldier by the knowledge that he possesses a store of rounds in his magazine. So great has the advantage of a magazine proved on service, that in the American war one man with the Spencer magazine rifle was considered equal to five with ordinary muzzle-loading rifles. The Turks employed magazine arms with much success at Plevna. Germany has adopted the Mauser magazine rifle with 8 rounds in the magazine. France was expected to adopt the Lobell repeater, with a bore of only 0·307 in. and a magazine containing 8 rounds, for her army; and her navy has for some time had the Kropatschek repeater. Austria has adopted the Mannlicher with a magazine of 5 rounds. Italy has approved of the Vetterli with a magazine of 11 rounds. The Russian Navy have the Evans repeater with the enormous store of 35 rounds in the butt, but no arm was approved for the Russian army yet. Switzerland, the lecturer said, had adopted the Vetterli, and Portugal the Guèdes with Kropatschek breech and repeating action. It is impossible for England to wait long in this state of things, and trials had been ordered with the Lee-Burton and Lee improved arms.

As to the bullet, the effect of the air in retarding it is proportioned directly to the square of the diameter which represents the surface on which the air presses, and inversely as the weight; that is, it is expressed by the fraction $\frac{D^2}{W}$,* which should be as low in value as possible. That of the Martini-Henry is 2·953. The Enfield-Martini bullet of 0·40-in. bore, which was lighter than the Martini, was by its smaller diameter brought down to about 2·90. Bullets of smaller bore still have now $\frac{D^2}{W} = 2\cdot093$. With very small bores, however, friction increases, and it has been found necessary to coat bullets in thin steel cases attached by tin. This steel case enables the bullet to take the grooving without fouling, and the case does not split in the process. Compressed powder has been found to give very good results. Smokeless powder is contemplated by some. Captain

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* The actual area is $\frac{\pi D^2}{2}$. It may be observed that since the weight depends on the specific gravity of the metal, and on its volume, and as the volume depends on the area of the cross section into the length, or $\frac{\pi D^2}{2} \times$ length, the action of air on solid bullets of the same material is inversely as their length; in other words, the power of a solid bullet to keep up velocity is simply proportional to its length.

James finally concluded that the best form of magazine arm, is a bolt arm with a magazine under the breech.

Whatever advantages magazine arms offer in the field, it appears as if they were still more desirable for Naval service, when the rifles are not likely to be carried any great distance from the ammunition stores on board.

The following is a brief description of some of the most approved magazine arms, grouping them in classes as far as practicable:—

1. Those in which the cartridges are placed in a tube underneath the barrel, in connection with the fore end of the stock, such as the Winchester, Vetterli, Kropatschek, and Mauser magazine rifles. The chief objection to this plan is that the balance of the weapon is constantly altered, as the magazine is being emptied; there is also the possible danger of the explosion of a charge in the magazine from a percussion cap projecting or being over-sensitive, since the base of each cartridge rests against the point of the one next in front of it.

2. Rifles in which the magazine is contained in a tube inserted in the butt of the stock, as the Spencer, Hotchkiss, Chaffee-Reece, Maxim, &c. In this case the balance of the rifle is not so greatly affected by the emptying of the magazine, although the objection remains of the apex of one cartridge resting against the base of the next.

3. "Central-magazine" arms, in which the magazine is just in rear of the cartridge chamber of the barrel, its shape and precise arrangement differing considerably in the various models.

The advantages of the central magazine are, (i.) that the balance of the rifle is not in the least affected by the varying number of charges in the receptacle, (ii.) that there is no danger of premature explosion from a projecting or over-sensitive percussion cap, and (iii.) that the cartridges can be far more easily inserted in the magazine than in either the first or second forms.

This class may conveniently be subdivided into:

(*a*). Drum or horseshoe magazines, as in the Schulhof, which is the best representative of this division.

(*b*). Box-form, inserted underneath the shoe in a slot just in front of the trigger guard. This is the Lee magazine; but the Spencer-Lee, the Pieri, and the Austrian Mannlicher have a similar form.

(*c*). Box-form, placed above or on one side of the shoe; the original Jarman, the Burton, Lee-Burton, and Owen-Jones have this form, which has the merit of dispensing with the magazine feed-spring, since the cartridges fall successively into the position for loading through the action of gravity alone. This kind of magazine

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WINCHESTER MAGAZINE GUN.

FIG. 4.

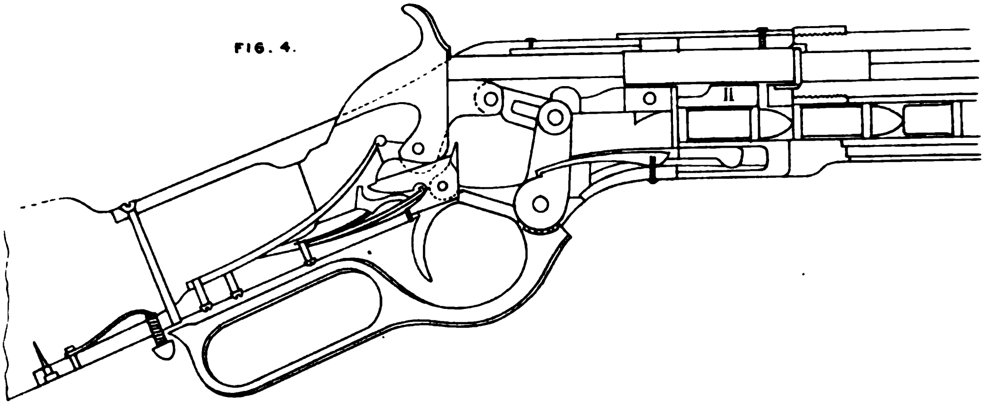
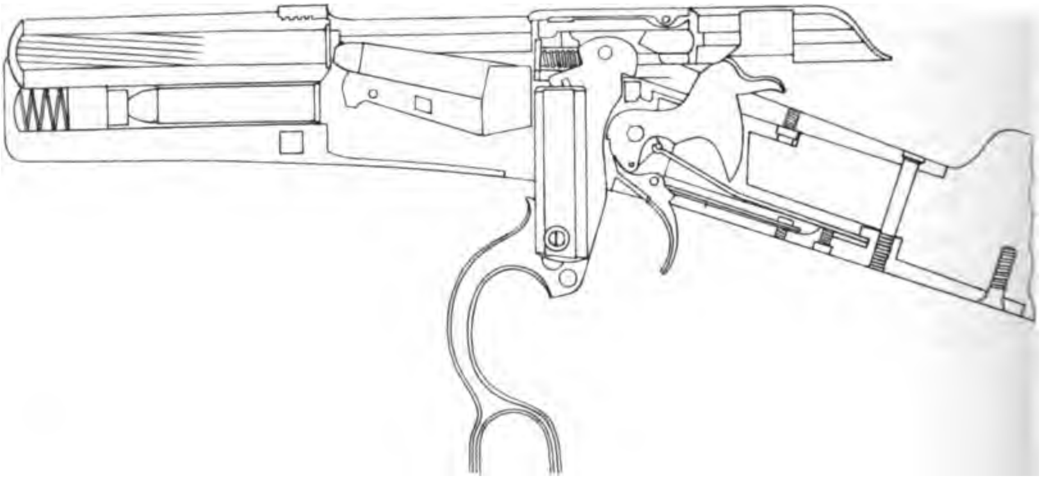


FIG. 5.



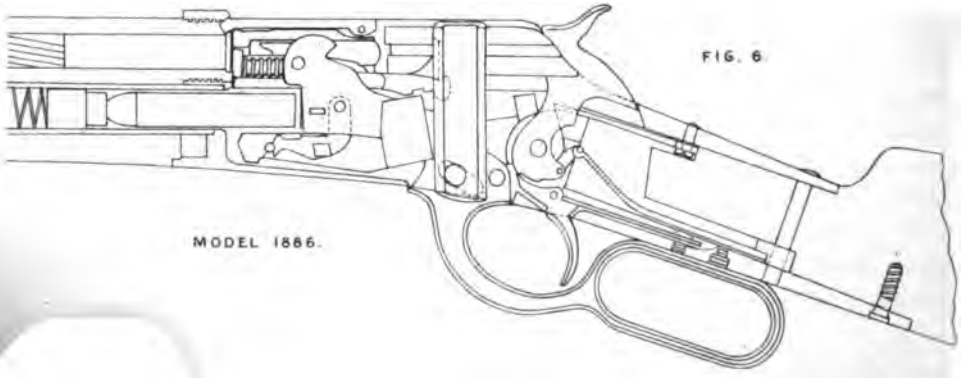


FIG. 6

MODEL 1886.

HANHART LITH.

is, however, much in the soldier's way, and is bad for aiming. In the Morris rifle, six cartridges are contained in a light skeleton frame, which fits on top of a receptacle on the left side of shoe, and which can be thrown away when empty. Nine cartridges in all can be contained in the rifle, viz., one in the chamber, one in the shoe, one in the receptacle, and six in the frame.

Winchester Rifle.

Winchester Rifle (Fig. 4, Pl. XIV.).—This weapon, probably the best known of the early repeating rifles, was an improvement on the "Henry" by the Winchester Arms Company, whose name was then given to it. The Henry was used with considerable effect during the American civil war; the Turkish cavalry, in the Russo-Turkish war, were armed with the Winchester, and it was also used by some of the Turkish infantry at Plevna. It is the first representative of Class I., in which the magazine is placed underneath the barrel, the cartridges being fed towards the breech by a spiral spring; the magazine can hold 15 rim-fire cartridges, and is filled through an aperture at the right side of the shoe or body, which is closed by an automatic spring cover.

The cartridge next for use is pressed by means of the spiral "feed" spring into a carrier or hopper in line with the magazine tube; this carrier is actuated by the lever forming the trigger guard. The motion of lowering this lever ejects the empty cartridge case, cocks the rifle, and raises the fresh cartridge in the carrier to the level of the barrel. On returning the lever to its original position, the carrier is lowered, the cartridge pressed home into the chamber, and the gun ready to be fired.

Winchester Repeating Rifle.

Winchester Repeating Rifle, New Model, 1886 (Figs. 5 and 6, Pl. XIV.).—This arm, which has much the same external appearance, and is manipulated in the same manner as the earlier patterns, possesses several distinctive features. These improvements are, taking them in the order of importance:

1. A most effective locking arrangement, which adds great strength to the breech-loading mechanism, and allows of the heaviest military charges being fired from the rifle. Two locking bolts (left unshaded in the sections, Figs. 5 and 6) have a vertical motion communicated to them by means of studs which work in a slotted groove in the hand lever; when the action is closed the bolts slide up into corresponding slots in the breech-bolt, one on either side of the firing pin or striker, thus securely locking the bolt.

2. The hand lever has a shorter radius, giving a less movement than in the older models, thus allowing the rifle to be manipulated with ease when at the shoulder.

3. A hook, attached to the lever, assists in withdrawing the cartridge from the magazine into the carrier; this permits of the magazine spring being comparatively weak, so that the magazine can be filled with ease.

The action of the rifle will be readily understood with the aid of the illustrations. The very first downward movement of the lever withdraws the firing pin within the front face of the breech-block, and locks it back until the arm is again ready for firing, while the empty cartridge case is extracted from the chamber and ejected; at the same time the elevator or carrier raises the fresh cartridge to the level of the bore, and the hammer is caused to rotate on its axis past the cocking position by the withdrawal of the breech-bolt. When the lever is raised to its normal position, the breech-bolt is pressed home into the chamber, and the carrier depressed to the level of the magazine; simultaneously the spiral main or striker spring is compressed, the hammer revolves forwards until the trigger bent is caught in the notch of the tumbler, thus cocking the arm, and the locking bolts are shot up through the breech-bolt; the rifle is now ready to be fired.

The magazine is filled, while the breech mechanism is closed, by passing the cartridges through an opening at the right side of the shoe, which is closed by an automatic spring cover. By a very simple arrangement this rifle will take cartridges of slightly varying weights of powder and projectile. These rifles are made in several calibres, from 0·32 in. to 0·45 in.

Kropatschek Magazine Rifle.

Kropatschek Magazine Rifle.—This rifle, which is the small arm of the French Navy, has a bolt-action resembling that of the Grass (see Fig. 7, Pl. XV.).

The magazine is a brass tube underneath the barrel, as in the Winchester, Vetterli, Mauser, and other rifles of Class I. It contains six cartridges, while a seventh can be placed in the trough or carrier T.

When the breech is opened by pulling back the bolt, a projection on the latter strikes the carrier at N, causing its front extremity to raise the cartridge into the position shown in the section. This movement is accelerated by the spring A acting against a knife-edge projection on the trough T; in the upper position of the trough, the spring acts upon one face of the angle, and upon the other face when in the lower position.

On closing the breech, the bolt pushes the cartridge into the chamber, and when the handle is locked down to the right, a part of the bolt presses against a stud, and thus depresses the trough to be ready to receive another cartridge from the magazine.

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FIG. 7. KROPATSCHEK MAGAZINE GUN.

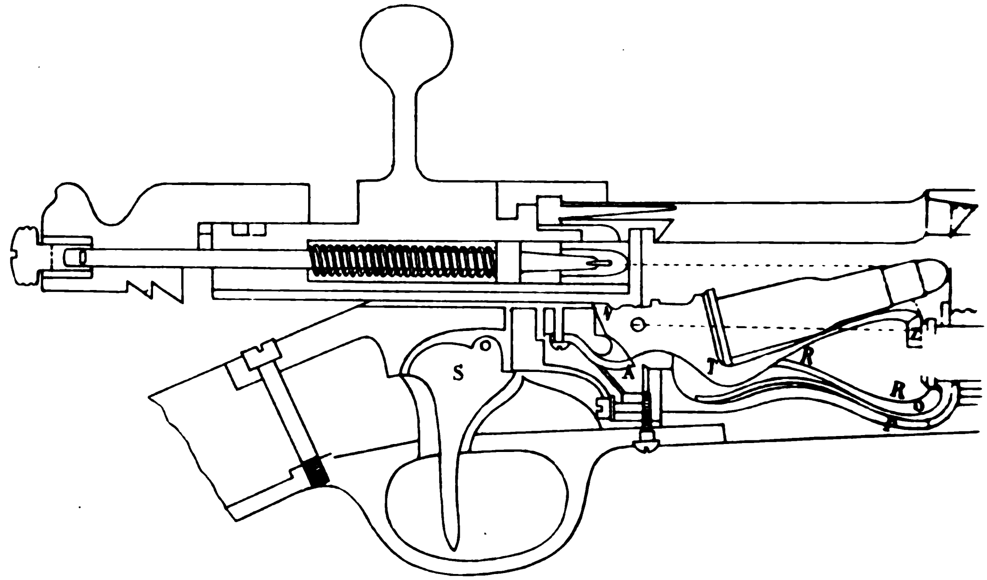


FIG. 8. LEE MAGAZINE GUN.

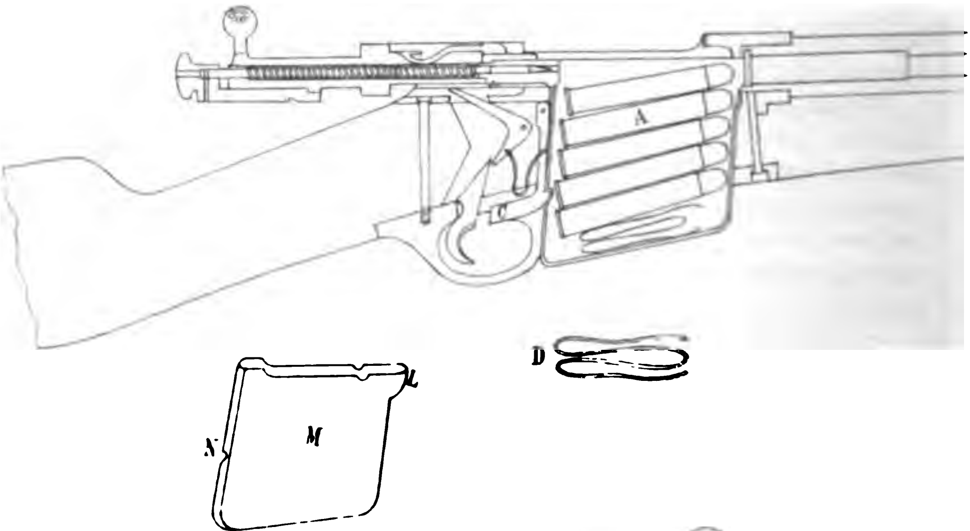
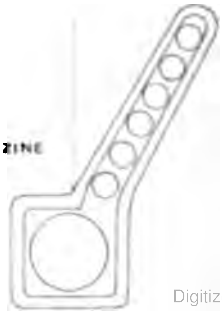


FIG. 9. JARMAN MAGAZINE



The magazine can be cut off and the rifle used as a single-loader by pushing forward a thumb-piece on the right side of the shoe.

There is a projection Z on the fore part of the carrier, which keeps the next cartridge from leaving the magazine while the trough is in the upper or loading position. A supplementary cartridge stop R, pivoted at P and having a spring underneath it, acts in conjunction with Z in retaining the cartridges in the magazine, and especially in preventing more than one at a time from passing out into the carrier when the latter is depressed; it also retains the cartridges in the magazine tube whilst the latter is being filled.

Lee Magazine Rifle.

Lee Magazine Rifle.—This arm (see Fig. 8, Pl. XV.), which occupied the place of honour in the report of the American "Board on Magazine Guns," embodied two new principles of considerable importance, viz., the central position of the magazine, and having it detachable with ease, so that two or more magazines can be carried by the soldier.

The breech action of the Lee does not materially differ in design from other bolt rifles, except that the bolt is in two pieces only—the body, or bolt proper, and the hammer or cocking piece. The firing-pin, or striker, is screwed into the hammer; the spiral main-spring, which surrounds the striker, is contained in a hollow in the body. The handle is placed at the rear end of the bolt, and bent down towards the stock, so as to allow the trigger to be reached without wholly quitting hold of the bolt.

The magazine M is simply a sheet-iron or steel box of a size to hold five cartridges, but there seems no reason why it should not be made of larger dimensions. It is detachable from the rifle, and is inserted from underneath, into a slot or mortise in the stock and in the shoe in front of the trigger-guard. A magazine catch C, just above the trigger-guard, engages in a notch N in the rear of the magazine, the projection L first entering a recess prepared for it in the shoe. There is a magazine spring D at the bottom of the magazine box which pushes the cartridges up into the shoe. The point of the top cartridge is pushed into the projection L, and this keeps the lower cartridges in their places in the box while the latter is detached. When the magazine is inserted in the rifle, the withdrawal of the bolt causes the top cartridge to be slightly drawn back so that it is now free to be fed up into the shoe by the magazine spring D.

There is a later pattern of magazine, which has its front face quite plain, with no projection L, as the magazine catch was found sufficient to hold the box in its place.

To use the rifle as a single-loader, formerly the magazine had to be detached. The later pattern, however, has two notches on the magazine for the catch C to engage in; when the magazine is inserted in the slot only as far as the upper notch, the rifle can be used only as a single-loader, but, on pressing the box home to the second notch, the magazine immediately comes into play.

The magazine can be released from the slot by an upward pressure on the lower projecting end of the magazine catch C, which is covered by the trigger-guard.

Improved Lee.

Improved Lee.—This rifle is precisely similar in principle to the Lee, the chief difference being that the magazine is permanently fixed in its slot underneath the shoe, and in front of the trigger-guard; the cartridges are inserted from above.

Lee-Burton.

Lee-Burton.—The bolt action is the same as the Lee, but the box-magazine is attached to the right side of the shoe, instead of being underneath, as in that rifle. When the magazine is raised to its higher position, the cartridges pass successively into the shoe by the action of gravity alone, and are thus pressed home into the chamber by the closing of the bolt.

A number of the Lee-Burton and improved Lee rifles are now being manufactured for issue to the troops, in order to undergo experimental trials on an extended scale.

Several other magazine rifles have the box central magazine, but placed in different positions as regards the shoe and the axis of the bore. In the original pattern of the Jarman (Sweden and Norway), the magazine is affixed to the upper part of the shoe, inclined at a considerable angle to the right hand (see vertical cross-section, Fig. 9, Pl. XV.). Here the operation of gravity obviates the necessity of a magazine spring, but the magazine was found to be very much in the way and liable to be injured; it has therefore been replaced by a magazine underneath the barrel, as in the Kropatschek and other rifles.

Defective Cutlass Bayonets.

Defective Cutlass Bayonets.—The discovery of a number of very defective cutlass bayonets in the hands of the Royal Navy is a sufficiently serious matter to call for notice. The following is a summary of the circumstances of the case taken from the Official Report of the Committee appointed to deal with it:—

On the adoption of the Martini-Henry rifle in 1871 a new pattern of sword bayonet was made, and "approved by the Admiralty. It had a straight instead of curved blade, 25½ in. long instead of 27 in., and of much less breadth and thickness."

In March, 1871, Sir J. Adye, then Director of Artillery, learned from Admiral Sir Arthur Hood, then Captain Hood, Director of Naval Ordnance, in answer to a suggestion of Sir J. Adye's to issue 12,000 surplus Snider sword bayonets for sea service, "that these weapons were not nearly so suitable for the present sword exercise as the cutlass-handled straight sword approved for issue with the Martini-Henry rifle." Sir A. Hood added, "I think it possible that those in store could be ground down at Enfield to the new pattern. If this can be done efficiently and at a moderate expense, the 12,000 sword bayonets could be so altered and issued as required, and the Navy would then be supplied with a more efficient weapon for defence than at present." "Will you give the necessary directions that, if it can be done efficiently, one of the present pattern is to be altered accordingly, and sent to the Admiralty for examination."

"On the 25th April, 1871, Colonel Dixon, then Superintendent of the Small Arms Factory, Enfield, sent a cutlass sword bayonet to Sir J. Adye for the approval of the Admiralty, after having it ground down." "Sir J. Adye then directed Colonel Dixon to call on Captain Hood and discuss the question. On the 5th May, 1871, Colonel Dixon reported to Sir J. Ayde that he had taken the papers to Captain Hood."

"On the 15th May, 1871, Captain Hood wrote to Sir J. Adye that he should object to receive the 12,000 surplus sword bayonets unaltered; that one had been ground down at Enfield to the Martini-Henry pattern, and he says: 'It has been well tried in the Excellent, and is considered to be quite equal to the approved pattern. Therefore I am prepared to accept the 12,000 sword bayonets, provided that they are altered both in shape of blade and hilt to the pattern approved.'"

Little work was performed until September, 1874, when—in answer to an inquiry from Captain Boys—Colonel Fraser, then Superintendent of Enfield, wrote on October 22nd, that if the Naval authorities "still approved of the altered sword bayonet, some in store had better be altered."

On 12th October, 1874, Sir J. Adye was informed by Colonel Fraser that 15,000 arms could be converted for £6000. The pattern was then again shown to Captain Boys (then Director of Naval Ordnance), who observed that it was well-considered in 1871, and that the conversion should be carried out as quickly as possible.

The report notices other arms besides the above-mentioned numbers: it deals with the conversion of 32,066 cutlasses and 50,511 sword bayonets, in all 82,577 arms, and shows how they were passed into the service.

It was reported after the African wars that cutlass bayonets had [illegible]ally on service, but it was difficult to trace the matter with certainty. Captain Rawson, in evidence before the Committee specially appointed, referred to one bending inside the body of an Arab at Abou Klea, so that the blue-jacket using the weapon was unable to withdraw it, and was killed by the next Arab.

The matter came to a head when Captain Rawson, then commanding H.M.S. Indus, found some cutlass bayonets bending easily by hand. A Board was ordered to sit, which condemned them as useless. Captain Luxmore then discovered that the sword bayonets of the Devastation were in a similar condition, and an investigation was ordered by the Parliamentary Committee above referred to, of which Sir H. Hussey Vivian, M.P., Bart., was President.

About the condition of many of the bayonets there could be no two opinions. The apportioning of blame is a more difficult matter. The naval officers concerned in the approval of the weapon urge that their approval had reference only to the convenience of the arm in use, and that receiving it as a genuine article, they had no thought of testing its strength. The manufacturing artillery officers in reply urge that it was not the question of a first pattern, but whether a converted arm, known to be identical in dimensions with one already issued, was equally good, which implies not a question of size or convenience, but strength. Then again, much depends on whether the arms actually issued were as good as the original pattern submitted. The Committee reported that there was no reason to doubt the efficiency of any arms supplied prior to 1871. They considered that "the conversion of these cutlasses and cutlass, sword bayonets was a most unwise step." These arms they pronounced "absolutely inefficient, untrustworthy, and unfit for service," "badly designed, the metal in them being unskilfully distributed;" and "inherently too weak to stand the vertical strain which thrusting weapons should endure without bending," and "for want of proper temper," "too soft for efficient service."

The Committee considered that the operation of conversion had injured the weapons, and the successive Superintendents of Enfield were closely examined as to the method of operation pursued. It appears, however, that the converted arms have in a long series of trials been found without exception to be no worse than those originally manufactured of the same pattern; and further, that so far was the temper from having been necessarily or in all cases destroyed, it was found that in the arms examined the metal when reduced to a soft state by annealing only had a tenacity of about 52·0 tons per inch, while the same metal existing in the weapons had about 98·0 tons tenacity, and, what is more important, the elastic strength of the blade as issued to the Navy was 84 tons per square inch, while in the natural state, as received from the makers, it is 32 tons. Also, while there could be no question as to the evil of a blunt sword bayonet bending in preference to entering the carcass of a sheep dressed in a soldier's coat, it is to be noticed that one of Wilkinson's costly swords behaved in the same way.

The following conclusions on this question suggest themselves. A sword bayonet is generally a comparatively weak bayonet. Lord Wolseley made the remarkable statement in evidence before another Committee, under the presidency of Judge Fitzjames Stephen, that while he thought a sword bayonet good against civilised troops, he would recommend triangular bayonets for use against savages. It appears most desirable that this question should be now fully faced. It should be clearly established what is the maximum strength that should be ensured in a cutlass bayonet, and if this falls so far short of the strength of a triangular bayonet that the weapon is not reliable in hand-to-hand work, it should doubtless be replaced by the triangular bayonet. On the other hand, supposing it be found that the 80 or 100 lbs. pressure that the cutlass bayonet can be made to bear without bending, is sufficient, it is difficult to see the precise advantage of the triangular bayonet possessing so high a resistance to bending as 320 lbs. Then it should be decided whether the weapon when over-strained is to break or bend, so that it may be tempered accordingly. The proceedings of the Committee showed clearly that while sword-makers generally have insisted that permanent bending was better than fracture, naval officers thought otherwise; the instance of the blue-jacket's death above mentioned supporting their view. Further, the system of testing should be such as to make it certain that all the blades issued come up to the standard reckoned on. Finally, the pattern approved should possess sufficient reserve of strength and extra metal to enable officers to grind their arms sharp and that repeatedly, without fear of weakening them to a dangerous extent. The experiments on the sheep's carcass clearly demonstrated the enormous difference in the result of a lunge with a sharp and a blunt weapon. A weapon may double up in a blunt condition which would pass through the carcass easily when sharp. On the whole it may be questioned whether cutlass bayonets ought not to be kept sharper habitually than has been the practice hitherto.

Roburite. A new explosive, "Roburite," has been introduced for mining purposes, and may be found valuable for bursting shells. It is the

Roburite.

invention of Dr. Carl Roth, a German chemist. It is said to have been adopted generally for dangerous mines in Germany, and has been successfully tried in England. It claims to possess the following advantages, among others:—It is quite safe to handle, and cannot be fired either by friction, percussion, flame, or heat, except in the shape of a detonation produced by fulminate of mercury. (2) Its explosion is so nearly free of all spark or flame that it can be used safely in the most fiery mines almost without tamping. (3) There is no danger from noxious gases after explosion, the products generated being so unstable as instantly to dissolve into harmless elements. (4) Its strength is very great, comparing advantageously with dynamite. "Blasting gelatine" is its most formidable rival. This has, in a great measure displaced dynamite for many purposes, but for safety in fiery mines requires to be inclosed in a water cartridge, and it does not offer the advantages which recommend Roburite for military purposes, namely, the remarkable non-liability to explosion.

NOTE ON TABLES OF BRITISH AND FOREIGN GUNS.

The greater part of the following Tables have been copied from the Austrian Marine Almanack for 1887. As in the *Annual* for last year, a few alterations and additions have been made, and the foreign measures have been converted into English. The perforations given in the above-mentioned work are considerably less than would be given on any system used in England, and would not be comparable with the English results. Moreover, a few obvious errors were detected, which could only be corrected by working out again. Hence the whole of the total energies, energies per inch circumference, and perforations, have been recalculated.

The British Table is the same given last year. It is the official one as abbreviated by Major Mackinlay, now corrected up to date by reference to original sources. In a few cases, where larger charges of slower burning powder have been substituted for smaller charges of quicker burning powder, the muzzle velocities and energies may be slightly incorrect. Where mistakes were detected in details of Elswick guns sent abroad, reference has been made to Elswick.

The Table of United States Naval Ordnance was obtained from Lieut. Jacques, U.S. Navy.

The Table for conversion of foreign measures is one worked out by Major Mackinlay, R.A., for his official Text Book of Gunnery. The figures are taken from various sources, chiefly Colonel Noble's useful Tables.

BRITISH RIFLED ORDNANCE.

(Chiefly founded on the official "List of Service Rifled Ordnance, 1886," corrected up to date.)

Ordnance.												Charge (full).	Projectile.						Ballistics (with full charges).				
Nature.				Chamber.				Rifling.													Perforation of wrought iron.		
								Twist one turn in															
Calibre or Pr.		Weight.	Mark and Service.	Length of bore, including chamber.	Diameter.	Length.	Capacity.	Least at breech.	Greatest at muzzle.	Distance at muzzle twist is uniform.	System.*	Weight.§	Diameter.	Weight.†		Value of $\frac{d^2}{w}$.	Value of $\frac{w}{d^3}$.	Muzzle velocity.	Total muzzle energy.	Muzzle energy per ton of gun.	At muzzle.	At 1000 yards range.	At 2000 yards range.
				ins.	ins.	ins.	cub. ins.	cals.	cals.	ins.		lbs.	ins.	lbs.	ozs.			f. s.	ft. tons.	ft. tons.	ins.	ins.	ins.
B.L. Guns (new type).	16·25-in.	111 tons.	S.	..	..	..	..	..	..	..	P.	960 S.B.C. 850 WBPr.	16·25	1800	0	0·146	0·421	2104 2148	55,250 57,580	— 518·8	— 35·2	— —	— —
	13·5-in.	67 tons.	II. S.	405·0	18·0	66·5	17,100	120	30	131·0	P.M.B.	520 Pr.^{1}B.	13·5	1250	0	..	..	2025	35,560	530·7	30·4	—	—
	12-in.	45 tons. 44 tons.	IV. V. S. III.	301·6	16·0	49·0	9,780	120	35	124·5	P.M.B.	295 Pr.^{1}B.	12·0	714	0	0·202	0·413	1892	18,060	420·1	22·5	20·6	18·8
	10-in.	29 tons.	II.	251·3	14·0	54·0	8,870	120	30	166·7	P.M.B.	250 Pr.^{1}B.	10·0	500	0	..	..	2100‡	15,290	—	—	—	—
	9·2-in.	21 & 22 tns.	I. II. S.	250·8	12·0	43·8	5,000	120	35	76·1	P.M.B.	160 Pr.^{1}B.	9·2	380	0	..	..	1835	8,876	..	18·0	16·6	—
	9·2-in.	24 & 22 tns.	III. IV. V. S.	261·3	12·0	43·8	5,000	120	30	120·4	P.M.B.	175 Pr.^{1}B.	9·2	380	0	0·238	0·477	2065	11,230	511·1	20·3	18·8	17·2
	8-in.	14 tons.	VI. S.	236·8	10·5	38·0	3,353	120	35	96·1	P.M.B.	118 Pr.^{1}B.	8·0	210	0	0·305	0·410	2200‡	7,060	508·2	17·4	15·6	13·5
	6-in.	5 tons.	V. S. L.	163·8	8·0	31.5	1,500	0	30	6·25	P.M.B.	42 Pb.^{2}	6·0	100·0		0·360	0·433	1920	2556	511·2	12·1	10·3	8·7
	5-in.	40 cwt.	III. S.	125·3	5·75	19·3	510	120	25	51·8	P.M.B.	16 S.Pb.	5·0	50	0	0·500	0·400	1780	1,098	549·0	8·6	6·8	5·4
	4-in.	26 cwt.	IV. S.	108·0	5·3	18·5	417	120	30	43·77	P.M.B.	12 S.Pb.	4·0	25	0	0·640	0·391	1900	625·1	500·8	7·3	5·7	4·5
	4-in.	13 cwt.	I. S.	59·2	4·5	8·12	126·5	116	35	11·39	P.M.B.	3¼ R.L.G.^{2}	4·0	25	0	0·640	0·391	1100	241·8	320·4	..	3·4	3·0
	12-pr.	7 cwt.	I. L.	84·4	3·625	11·2	118	120	28	35·8	P.M.B.	4 S.Pb.	3·0	12	5	0·720	0·463	1710	253·5	724·3	—	—	—
M.L. Guns.	17·72-in.	100 tons.	I. L.	363·0	19·7	59·72	16,957	150	50	2·88	P.M.M.	450 Pr^1 or ^{2}B	17·72	1968	0	0·159	0·374	1548	32,710	327·1	24·5	23·2	21·4
	16-in.	80 tons.	I. S. & L.	288·0	18·0	59·6	14,600	0	50	0	P.M.M.	450 Pr.^{1}B.	16·0	1684	0	0·152	0·411	1590	29,530	369·1	24·7	23·1	21·3
	12·5-in.	38 tons.	II. S. & L.	198·0	14·0	41·125	6,000	438	35	0	W.	210 Pr.^{2} or Pr.^{1} black	12·5	809	6	0·193	0·415	1575	13,930	366·5	18·4	17·5	15·9
	12-in.	35 tons.	I. S. & L.	162·5	Unchambered			0	35	0	W.	140 Pb.^{2}	12·0	706	12	0·204	0·409	1390	9,469	250·5	15·9	14·4	13·1
	12-in.	25 tons.	II. S. & L.	145·0	"			100	50	0	W.	85 Pb.^{2}	12·0	608	6	0·237	0·352	1292	7,046	281·8	13·5	12·6	11·4
	11-in.	25 tons.	II. S. & L.	133·0	"			0	35	0	W.	85 Pb.	11·0	542	14	0·223	0·408	1360	7,015	280·6	14·3	12·8	11·5
	10-in.	18 tons.	II. S & L.	145·5	"			100	40	0	W.	70 Pb.	10·0	406	9	0·246	0·406	1379	5,356	297·5	12·9	11·6	10·4

M.L. Guns.	9-in.	12 tons.	V. S. & L.	125·0	Unchambered.			0	45	0	W.	50 Pb.	9·0	253	9	0·320	0·347	1440	3,695	303·6	11·3	9·6	8·4
	8-in.	9 tons.	III. S.	118·0	"			0	40	0	W.	35 Pb.	7·92	174	12	0·359	0·352	1384	2,391	258·1	9·6	8·1	7·0
	7-in.	90 cwt.	I. S.	110·0	"			35	35	All	W.	22 Pb.	6·92	112	1	0·427	0·338	1325	1,400	..	..	6·5	5·6
	7-in.	6½ tons.	III. S. & L.	111·0	"			35	35	All	W.	30 Pb.	6·92	112	1	..	..	1525	1,854	..	..	7·5	6·1
	7-in.	7 tons.	IV. L.	126·0	"			35	35	All	W.	30 Pb.	6·92	112	1	0·427	0·338	1561	1,943	270·6	9·5	7·7	6·4
	6·6-in.	70 cwt.	I. L.	97·5	6·8	21·0	709	100	35	13·2	P.M.M.	25 Pb.	6·6	97	12	0·446	0·340	1416	1,398	388·1	—	—	—
	64-pr.	64 cwt.	I. II. S & L.	98·0	Unchambered.			40	40	All	Pl.	8½ R.L.G.^{4}	6·28	67	2	0·588	0·271	1125	570	—	—	—	—
	64-pr.	64 cwt.	III. S. & L.	97·5	"			40	40	All	Pl.	10 R.L.G.^{4}	6·28	67	2	0·588	0·271	1260	700	231·3	—	—	—
	40-pr.	35 cwt.	II. L.	104·5	"			35	35	All	W.	6½ R.L.G.^{4}	4·75	40	14	0·552	0·382	1425	576	329·4	—	—	—
	25-pr.	18 cwt.	I. L.	98·0	"			35	35	All	W.	4½ R.L.G.^{4}	3·94	25	7	0·605	0·420	1340	320	356·0	—	—	—
	16-pr.	12 cwt.	I. L.	68·4	"			30	30	All	F.M.	3 R.L.G.^{2}	3·54	16	4	0·771	0·366	1355	207	344·7	—	—	—
	13-pr.	8 cwt.	I. L.	84·0	3·15	14·13	109	100	30	9·0	P.M.M.	3¼ R.L.G.^{2}	3·0	13	1	0·689	0·484	1560	220	540·8	—	—	—
	9-pr.	8 cwt. 6 cwt.	II. III. S. & L. IV.	66·0	Unchambered.			30	30	All	F.M.	1¾ R.L.G.^{2} 1½ R.L.G.^{2}	2·94	9	2	0·946	0·359	1320	122	407·6	—	—	—
	2·5-in.	400 lbs.	I. L.	66·5	2·56	11·07	54	80	30	3·53	P.M.M.	1½ R.L.G.^{2}	2·5	7	0	0·893	0·448	1440	96	538·4	—	—	—
	7-pr.	200 lbs.	IV. S. & L.	36·0	Unchambered.			20	20	All	F.	¾ R.F.G.	2·94	7	5	1·181	0·288	950	46	513·1	—	—	—
R.B.L. guns (screw).	7-in.	82 cwt.	S. & L.	99·58	7·2	16·0	620·0	37	37	All	P.	11 R.L.G.	7·0	109	0	0·450	0·318	1100	915	223·1	—	—	—
	40-pr.	35 cwt.	S. & L.	106·3	4·96	13·5	257·8	36½	36½	All	P.	5 R.L.G.	4·75	40	2	0·562	0·374	1180	388	221·4	—	—	—
	20-pr.	16 cwt.	L.	84·0	3·94	12·0	143·0	38	38	All	P.	2½ R.L.G.^{2} or R.L.G.	3·75	21	13	0·645	0·414	1130	193	241·5	—	—	—
		15&13cwt.	S.	54·1	3·94	11·0	131·0	38	38	All	P.	2½	3·75	21	13	0·645	0·414	1000	156	—	—	—	—
	12-pr.	8 cwt.	S. & L.	61·38	3·2	8·5	66·0	38	38	All	P.	1½	3·0	11	4	0·800	0·417	1239	118	294·5	—	—	—
	9-pr.	6 cwt.	S. & L.	52·5	3·2	7·0	55·1	38	38	All	P.	1¼	3·0	8	8	1·059	0·315	1055	66	218·8	—	—	—
Quick Firing Guns.																					Mild steel plate.		
Hotchkiss.	6-pr.	8 cwt.	S.	..	..	..	..	..	..	..	..	1 15	2·25	6	0	0·844	0·527	1820	137·8	344·5	3·2	2·0	—
Nordenfelt.	6-pr.	6 cwt.	S.	..	..	..	..	0	26	0	..	1 15	2·25	6	0	0·844	0·527	1860	143.9	479·6	3·3	2·1	—
Hotchkiss.	3-pr.	4 cwt.	S.	..	..	..	..	25	25	All	..	1 8	1·85	3	8	0·978	0·553	2000	97·1	485·5	2·9	1·8	—
Machine Guns.												grains.		oz.	grs.								
Nordenfelt, 4 bar.	1-in.	447 lbs.	III. S.	35·48	..	..	..	35	35	All	H.	625	1·0	7¾	0	2·207	0·453	..	..	..	¾-in. at 200 yar		—
Gatling, 10 bar.	0·65-in.	787 lbs.	S. & L.	33·0	..	..	..	46·5	46·5	All	H.	270	0·65	0	1425	2·109	0·730	..	..	..	Not know	—	—
Gardner, 2 bar.	0·45-in.	131 lbs.	S. & L.	30·0	..	..	..	48·9	48·9	All	H.	85	0·450		480	2·952	0·751	..	..	..	Sam		

S., Sea-service gun; L., Land-service. The Roman numeral is the number of the pattern given.

* P means Polygroove; M.M., Maitland muzzle-loading, and M.B., Maitland breech-loading; Pl., Plain; W., Woolwich; F., French; F.M., French modified; H., Henry. † For the higher r given is for Palliser shot; for the lower natures it is for filled common shell. ‡ Estimated. § S.B.C. (in column for charge) means Slow-burning Cocoa; W.B.Pr., Westphali Prismatic Brown; Pb., Pebble; R.L.G., Rifle Large Grain; L.G., Large Grain.

BRITISH RIFLED ORDNANCE.

(Chiefly founded on the official "List of Service Rifled Ordnance, 1886," corrected up to date.)

Ordnance.												Charge (full).	Projectile.						Ballistics (with full charges).				
Nature.				Chamber.				Rifling.													Perforation of wrought iron.		
								Twist one turn in															
Calibre or Pr.		Weight.	Mark and Service.	Length of bore, including chamber.	Diameter.	Length.	Capacity.	Least at breech.	Greatest at muzzle.	Distance at muzzle twist is uniform.	System.*	Weight.§	Diameter.	Weight.†		Value of $\frac{d^2}{w}$.	Value of $\frac{w}{d^3}$.	Muzzle velocity.	Total muzzle energy.	Muzzle energy per ton of gun.	At muzzle.	At 1000 yards range.	At 2000 yards range.
				ins.	ins.	ins.	cub. ins.	cals.	cals.	ins.		lbs.	ins.	lbs.	ozs.			f. s.	ft. tons.	ft. tons.	ins.	ins.	ins.
B.L. Guns (new type).	16·25-in.	111 tons.	S.	..	..	..	..	..	..	..	P.	960 S.B.C. 850 WBPr.	16·25	1800	0	0·146	0·421	2104 2148	55,250 57,580	— 518·8	— 35·2	— —	— —
	13·5-in.	67 tons.	II. S.	405·0	18·0	66·5	17,100	120	30	131·0	P.M.B.	520 Pr.[1]B.	13·5	1250	0	..	..	2025	35,560	530·7	30·4	—	—
	12-in.	45 tons. 44 tons.	IV. V. S. III.	301·6	16·0	49·0	9,780	120	35	124·5	P.M.B.	295 Pr.[1]B.	12·0	714	0	0·202	0·413	1892	18,060	420·1	22·5	20·6	18·8
	10-in.	29 tons.	II.	251·3	14·0	54·0	8,370	120	30	166·7	P.M.B.	250 Pr.[1]B.	10·0	500	0	..	..	2100‡	15,290	—	—	—	—
	9·2-in.	21 & 22 tns.	I. II. S.	250·8	12·0	43·8	5,000	120	35	76·1	P.M.B.	160 Pr.[1]B.	9·2	380	0	..	..	1835	8,876	..	18·0	16·6	—
	9·2-in.	24 & 22 tns.	III. IV. V. S.	261·3	12·0	43·8	5,000	120	30	120·4	P.M.B.	175 Pr.[1]B.	9·2	380	0	0·238	0·477	2065	11,230	511·1	20·3	18·8	17·2
	8-in.	14 tons.	VI. S.	236·8	10·5	38·0	3,353	120	35	96·1	P.M.B.	118 Pr.[1]B.	8·0	210	0	0·305	0·410	2200‡	7,060	508·2	17·4	15·6	13·5
	6-in.	5 tons.	V. S. L.	163·8	8·0	31.5	1,500	0	30	6·25	P.M.B.	42 Pb.[3]	6·0	100·0		0·360	0·433	1920	2556	511·2	12·1	10·3	8·7
	5-in.	40 cwt.	III. S.	125·3	5·75	19·3	510	120	25	51·8	P.M.B.	16 S.Pb.	5·0	50	0	0·500	0·400	1780	1,098	549·0	8·6	6·8	5·4
	4-in.	26 cwt.	IV. S.	108·0	5·3	18·5	417	120	30	43·77	P.M.B.	12 S.Pb.	4·0	25	0	0·640	0·391	1900	625·1	500·8	7·3	5·7	4·5
	4-in.	13 cwt.	I. S.	59·2	4·5	8·12	126·5	116	35	11·39	P.M.B.	3¼ R.L.G.[2]	4·0	25	0	0·640	0·391	1100	241·8	320·4	..	3·4	3·0
	12-pr.	7 cwt.	I. L.	84·4	3·625	11·2	118	120	28	35·8	P.M.B.	4 S.Pb.	3·0	12	5	0·720	0·463	1710	253·5	724·3	—	—	—
M.L. Guns.	17·72-in.	100 tons.	I. L.	363·0	19·7	59·72	16,957	150	50	2·88	P.M.M.	450 Pr[1] or [2]B	17·72	1968	0	0·159	0·374	1548	32,710	327·1	24·5	23·2	21·4
	16-in.	80 tons.	I. S. & L.	288·0	18·0	59·6	14,600	0	50	0	P.M.M.	450 Pr.[1]B.	16·0	1684	0	0·152	0·411	1590	29,530	369·1	24·7	23·1	21·3
	12·5-in.	38 tons.	II. S. & L.	198·0	14·0	41·125	6,000	488	35	0	W.	210 Pr.[2] or Pr.[1] black	12·5	809	6	0·193	0·415	1575	13,930	366·5	18·4	17·5	15·9
	12-in.	35 tons.	I. S. & L.	162·5	Unchambered			0	35	0	W.	140 Pb.[3]	12·0	706	12	0·204	0·409	1390	9,469	250·5	15·9	14·4	13·1
	12-in.	25 tons.	II. S. & L.	145·0	„			100	50	0	W.	85 Pb.[2]	12·0	608	6	0·237	0·352	1292	7,046	281·8	13·5	12·6	11·4
	11-in.	25 tons.	II. S. & L.	133·0	„			0	35	0	W.	85 Pb.	11·0	542	14	0·223	0·408	1360	7,015	280·6	14·3	12·8	11·5
	10-in.	18 tons.	II. S. & L.	145·5	„			100	40	0	W.	70 Pb.	10·0	406	9	0·246	0·406	1379	5,356	297·5	12·9	11·6	10·4

M.L. Guns.	9-in.	12 tons.	V. S. & L.	125·0	Unchambered.			0	45	0	W.	50 Pb.	9·0	253	9	0·320	0·347	1440	3,695	303·6	11·3	9·6	8·4
	8-in.	9 tons.	III. S.	118·0	"			0	40	0	W.	35 Pb.	7·92	174	12	0·359	0·352	1384	2,391	258·1	9·6	8·1	7·0
	7-in.	90 cwt.	I. S.	110·0	"			35	35	All	W.	22 Pb.	6·92	112	1	0·427	0·338	1325	1,400	..	..	6·5	5·6
	7-in.	6½ tons.	III. S. & L.	111·0	"			35	35	All	W.	30 Pb.	6·92	112	1	..	..	1525	1,854	..	..	7·5	6·1
	7-in.	7 tons.	IV. L.	126·0	"			35	35	All	W.	30 Pb.	6·92	112	1	0·427	0·338	1561	1,943	270·6	9·5	7·7	6·4
	6·6-in.	70 cwt.	I. L.	97·5	6·8	21·0	709	100	35	13·2	P.M.M.	25 Pb.	6·6	97	12	0·446	0·340	1416	1,398	388·1	—	—	—
	64-pr.	64 cwt.	I. II. S & L.	98·0	Unchambered.			40	40	All	Pl.	8½ R.L.G.[4]	6·28	67	2	0·588	0·271	1125	570	—	—	—	—
	64-pr.	64 cwt.	III. S. & L.	97·5	"			40	40	All	Pl.	10 R.L.G.[4]	6·28	67	2	0·588	0·271	1260	700	231·3	—	—	—
	40-pr.	35 cwt.	II. L.	104·5	"			35	35	All	W.	6½ R.L.G.[4]	4·75	40	14	0·552	0·382	1425	576	329·4	—	—	—
	25-pr.	18 cwt.	I. L.	98·0	"			35	35	All	W.	4½ R.L.G.[4]	3·94	25	7	0·605	0·420	1340	320	356·0	—	—	—
	16-pr.	12 cwt.	I. L.	68·4	"			30	30	All	F.M.	3 R.L G.[2]	3·54	16	4	0·771	0·366	1355	207	344·7	—	—	—
	13-pr.	8 cwt.	I. L.	84·0	3·15	14·13	109	100	30	9·0	P.M.M.	3¼ R.L.G.[2]	3·0	13	1	0·689	0·484	1560	220	540·8	—	—	—
	9-pr.	8 cwt. 6 cwt.	II. III. S.&L. IV.	66·0	Unchambered.			30	30	All	F.M.	1¾ R.L.G.[2] 1½ R.L.G.[2]	2·94	9	2	0·946	0·359	1320	122	407·6	—	—	—
	2·5-in.	400 lbs.	I. L.	66·5	2·56	11·07	54	80	30	3·53	P.M.M.	1½ R.L.G.[2]	2·5	7	0	0·893	0·448	1440	96	538·4	—	—	—
	7-pr.	200 lbs.	IV. S. & L.	36·0	Unchambered.			20	20	All	F.	¾ R.F.G.	2·94	7	5	1·181	0·288	950	46	513·1	—	—	—
R.B.L. guns (screw).	7-in.	82 cwt.	S. & L.	99·58	7·2	16·0	620·0	37	37	All	P.	11 RL.G.	7·0	109	0	0·450	0·318	1100	915	223·1	—	—	—
	40-pr.	35 cwt.	S. & L.	106·3	4·96	13·5	257·8	36½	36½	All	P.	5 R.L.G.	4·75	40	2	0·562	0·374	1180	388	221·4	—	—	—
	20-pr.	16 cwt.	L.	84·0	3·94	12·0	143·0	38	38	All	P.	2½ R.L.G.[2] or R.L.G.	3·75	21	13	0·645	0·414	1130	193	241·5	—	—	—
		15&13cwt.	S.	54·1	3·94	11·0	131·0	38	38	All	P.	2½	3·75	21	13	0·645	0·414	1000	156	—	—	—	—
	12-pr.	8 cwt.	S. & L.	61·38	3·2	8·5	66·0	38	38	All	P.	1½	3·0	11	4	0·800	0·417	1239	118	294·5	—	—	—
	9-pr.	6 cwt.	S. & L.	52·5	3·2	7·0	55·1	38	38	All	P.	1¼	3·0	8	8	1·059	0·315	1055	66	218·8	—	—	—
Quick Firing Guns.																					Mild steel plate.		
Hotchkiss.	6-pr.	8 cwt.	S.	..	..	..	..	..	..	..	..	1 15	2·25	6	0	0·844	0·527	1820	137·8	344·5	3·2	2·0	—
Nordenfelt	6-pr.	6 cwt.	S.	..	..	..	..	0	26	0	..	1 15	2·25	6	0	0·844	0·527	1860	143.9	479·6	3·3	2·1	—
Hotchkiss.	3-pr.	4 cwt.	S.	..	..	..	..	25	25	All	..	1 8	1·85	3	8	0·978	0·553	2000	97·1	485·5	2·9	1·8	—
Machine Guns.												grains.		oz.	grs.								
Nordenfelt, 4 bar.	1-in.	447 lbs.	III. S.	35·48	..	..	..	35	35	All	H.	625	1·0	7¾	0	2·207	0·453	..	..	..	¾-in. at 200 yar		—
Gatling, 10 bar.	0·65-in.	787 lbs.	S. & L.	33·0	..	..	..	46·5	46·5	All	H.	270	0·65	0	1425	2·109	0·730	..	..	..	Not know	—	—
Gardner, 2 bar.	0·45-in.	131 lbs.	S. & L.	30·0	..	..	..	48·9	48·9	All	H.	85	0·45	0	480	2·952	0·751	..	..	..	Sam		

S., Sea-service gun; L., Land-service. The Roman numeral is the number of the pattern given.

* P means Polygroove; M.M., Maitland muzzle-loading, and M.B., Maitland breech-loading; Pl., Plain; W., Woolwich; F., French; F.M., French modified; H., Henry. † For the higher r
given is for Palliser shot; for the lower natures it is for filled common shell. ‡ Estimated. § S.B.C. (in column for charge) means Slow-burning Cocoa; W.B.Pr., Westphali
Prismatic Brown; Pb., Pebble; R.L.G., Rifle Large Grain; L.G., Large Grain.

BRITISH RIFLED ORDNANCE.

(Chiefly founded on the official "List of Service Rifled Ordnance, 1886," corrected up to date.)

	Ordnance.											Charge (full).	Projectile.							Ballistics (with full charges).				
	Nature.			Chamber.				Rifling.														Perforation of wrought iron.		
								Twist one turn in																
	Calibre or Pr.	Weight.	Mark and Service.	Length of bore, including chamber.	Diameter.	Length.	Capacity.	Least at breech.	Greatest at muzzle.	Distance at muzzle twist is uniform.	System.*	Weight.§	Diameter.	Weight.†		Value of $\frac{d^2}{w}$.	Value of $\frac{w}{d^3}$.	Muzzle velocity.	Total muzzle energy.	Muzzle energy per ton of gun.	At muzzle.	At 1000 yards range.	At 2000 yards range.
				ins.	ins.	ins.	cub. ins.	cals.	cals.	ins.		lbs.	ins.	lbs.	ozs.			f. s.	ft. tons.	ft. tons.	ins.	ins.	ins.
B.L. Guns (new type).	16·25-in.	111 tons.	S.	..	..	..	..	..	..	..	P.	960 S.B.C. 850 WBPr.	16·25	1800	0	0·146	0·421	2104 2148	55,250 57,580	— 518·8	— 35·2	— —	— —
	13·5-in.	67 tons.	II. S.	405·0	18·0	66·5	17,100	120	30	131·0	P.M.B.	520 Pr.[1]B.	13·5	1250	0	..	..	2025	35,560	530·7	30·4	—	—
	12-in.	45 tons. 44 tons.	IV. V. S. III.	301·6	16·0	49·0	9,780	120	35	124·5	P.M.B.	295 Pr.[1]B.	12·0	714	0	0·202	0·413	1892	18,060	420·1	22·5	20·6	18·8
	10-in.	29 tons.	II.	251·3	14·0	54·0	8,370	120	30	166·7	P.M.B.	250 Pr.[1]B.	10·0	500	0	..	..	2100‡	15,290	—	—	—	—
	9·2-in.	21 & 22 tns.	I. II. S.	250·8	12·0	43·8	5,000	120	35	76·1	P.M.B.	160 Pr.[1]B.	9·2	380	0	..	..	1835	8,876	..	18·0	16·6	—
	9·2-in.	24 & 22 tns.	III. IV. V. S.	261·3	12·0	43·8	5,000	120	30	120·4	P.M.B.	175 Pr.[1]B.	9·2	380	0	0·238	0·477	2065	11,230	511·1	20·3	18·8	17·2
	8-in.	14 tons.	VI. S.	236·8	10·5	38·0	3,353	120	35	96·1	P.M.B.	118 Pr.[1]B.	8·0	210	0	0·305	0·410	2200‡	7,060	508·2	17·4	15·6	13·5
	6-in.	5 tons.	V. S. L.	163·8	8·0	31.5	1,500	0	30	6·25	P.M.B.	42 Pb.[2]	6·0	100·0		0·360	0·433	1920	2556	511·2	12·1	10·3	8·7
	5-in.	40 cwt.	III. S.	125·3	5·75	19·3	510	120	25	51·8	P.M.B.	16 S.Pb.	5·0	50	0	0·500	0·400	1780	1,098	549·0	8·6	6·8	5·4
	4-in.	26 cwt.	IV. S.	108·0	5·3	18·5	417	120	30	43·77	P.M.B.	12 S.Pb.	4·0	25	0	0·640	0·391	1900	625·1	500·8	7·3	5·7	4·5
	4-in.	13 cwt.	I. S.	59·2	4·5	8·12	126·5	116	35	11·39	P.M.B.	3¼ R.L.G[2].	4·0	25	0	0·640	0·391	1100	241·8	320·4	..	3·4	3·0
	12-pr.	7 cwt.	I. L.	84·4	3·625	11·2	118	120	28	35·8	P.M.B.	4 S.Pb.	3·0	12	5	0·720	0·463	1710	253·5	724·3	—	—	—
M.L. Guns.	17·72-in.	100 tons.	I. L.	363·0	19·7	59·72	16,957	150	50	2·88	P.M.M.	450 Pr[1] or [2] B	17·72	1968	0	0·159	0·374	1548	32,710	327·1	24·5	23·2	21·4
	16-in.	80 tons.	I. S. & L.	288·0	18·0	59·6	14,600	0	50	0	P.M.M.	450 Pr.[1]B.	16·0	1684	0	0·152	0·411	1590	29,530	369·1	24·7	23·1	21·3
	12·5-in.	38 tons.	II. S. & L.	198·0	14·0	41·125	6,000	438	35	0	W.	210 Pr.[2] or Pr.[1] black	12·5	809	6	0·193	0·415	1575	13,930	366·5	18·4	17·5	15·9
	12-in.	35 tons.	I. S. & L.	162·5	Unchambered			0	35	0	W.	140 Pb.[3]	12·0	706	12	0·204	0·409	1390	9,469	250·5	15·9	14·4	13·1
	12-in.	25 tons.	II. S. & L.	145·0	„			100	50	0	W.	85 Pb.[3]	12·0	608	6	0·237	0·352	1292	7,046	281·8	13·5	12·6	11·4
	11-in.	25 tons.	II. S. & L.	133·0	„			0	35	0	W.	85 Pb.	11·0	542	14	0·223	0·408	1360	7,015	280·6	14·3	12·8	11·5
	10-in.	18 tons.	II. S & L.	145·5	„			100	40	0	W.	70 Pb.	10·0	406	9	0·246	0·406	1879	5,356	297·5	12·9	11·6	10·4

M.L. Guns.	9-in.	12 tons.	V. S. & L.	125·0	Unchambered.			0	45	0	W.	50 Pb.	9·0	253	9	0·320	0·347	1440	3,695	303·6	11·3	9·6	8·4
	8-in.	9 tons.	III. S.	118·0	„			0	40	0	W.	35 Pb.	7·92	174	12	0·359	0·352	1384	2,391	258·1	9·6	8·1	7·0
	7-in.	90 cwt.	I. S.	110·0	„			35	35	All	W.	22 Pb.	6·92	112	1	0·427	0·338	1325	1,400	..	..	6·5	5·6
	7-in.	6½ tons.	III. S. & L.	111·0	„			35	35	All	W.	30 Pb.	6·92	112	1	..	..	1525	1,854	..	..	7·5	6·1
	7-in.	7 tons.	IV. L.	126·0	„			35	35	All	W.	30 Pb.	6·92	112	1	0·427	0·338	1561	1,943	270·6	9·5	7·7	6·4
	6·6-in.	70 cwt.	I. L.	97·5	6·8	21·0	709	100	35	13·2	P.M.M.	25 Pb.	6·6	97	12	0·446	0·340	1416	1,398	388·1	—	—	—
	64-pr.	64 cwt.	I. II. S & L.	98·0	Unchambered.			40	40	All	Pl.	8½ R.L.G.[4]	6·28	67	2	0·588	0·271	1125	570	—	—	—	—
	64-pr.	64 cwt.	III. S. & L.	97·5	„			40	40	All	Pl.	10 R.L.G.[4]	6·28	67	2	0·588	0·271	1260	700	231·3	—	—	—
	40-pr.	35 cwt.	II. L.	104·5	„			35	35	All	W.	6½ R.L.G.[4]	4·75	40	14	0·552	0·382	1425	576	329·4	—	—	—
	25-pr.	18 cwt.	I. L.	98·0	„			35	35	All	W.	4½ R.L.G.[4]	3·94	25	7	0·605	0·420	1340	320	356·0	—	—	—
	16-pr.	12 cwt.	I. L.	68·4	„			30	30	All	F.M.	3 R.L.G.[2]	3·54	16	4	0·771	0·366	1355	207	344·7	—	—	—
	13-pr.	8 cwt.	I. L.	84·0	3·15	14·13	109	100	30	9·0	P.M.M.	3¼ R.L.G.[2]	3·0	13	1	0·689	0·484	1560	220	540·8	—	—	—
	9-pr.	8 cwt. 6 cwt.	II.III.S.&L. IV.	66·0	Unchambered.			30	30	All	F.M.	1¾ R.L.G.[2] 1½ R.L.G.[2]	2·94	9	2	0·946	0·359	1330	122	407·6	—	—	—
	2·5-in.	400 lbs.	I. L.	66·5	2·56	11·07	54	80	30	3·53	P.M.M.	1½ R.L.G.[2]	2·5	7	0	0·893	0·448	1440	96	538·4	—	—	—
	7-pr.	200 lbs.	IV. S. & L.	36·0	Unchambered.			20	20	All	F.	¾ R.F.G.	2·94	7	5	1·181	0·288	950	46	513·1	—	—	—
R.B.L. guns (screw).	7-in.	82 cwt.	S. & L.	99·58	7·2	16·0	620·0	37	37	All	P.	11 R.L.G.	7·0	109	0	0·450	0·318	1100	915	223·1	—	—	—
	40-pr.	35 cwt.	S. & L.	106·3	4·96	13·5	257·8	36½	36½	All	P.	5 R.L.G.	4·75	40	2	0·562	0·374	1180	388	221·4	—	—	—
	20-pr.	16 cwt.	L.	84·0	3·94	12·0	143·0	38	38	All	P.	2½ R.L.G.[2] or R.L.G.	3·75	21	13	0·645	0·414	1130	193	241·5	—	—	—
		15&13cwt.	S.	54·1	3·94	11·0	131·0	38	38	All	P.	2½	3·75	21	13	0·645	0·414	1000	156	—	—	—	—
	12-pr.	8 cwt.	S. & L.	61·38	3·2	8·5	66·0	38	38	All	P.	1½	3·0	11	4	0·800	0·417	1239	118	294·5	—	—	—
	9-pr.	6 cwt.	S. & L.	52·5	3·2	7·0	55·1	38	38	All	P.	1¼	3·0	8	8	1·059	0·315	1055	66	218·8	—	—	—
Quick Firing Guns.																					Mild steel plate.		
Hotchkiss .	6-pr.	8 cwt.	S.	..	..	..	..	..	..	..	..	1 15	2·25	6	0	0·844	0·527	1820	137·8	344·5	3·2	2·0	—
Nordenfelt	6-pr.	6 cwt.	S.	..	..	..	..	0	26	0	..	1 15	2·25	6	0	0·844	0·527	1860	143.9	479·6	3·3	2·1	—
Hotchkiss .	3-pr.	4 cwt.	S.	..	..	..	..	25	25	All	..	1 8	1·85	3	8	0·978	0·553	2000	97·1	485·5	2·9	1·8	—
Machine Guns.												grains.		oz.	grs.								
Nordenfelt, 4 bar.	1-in.	447 lbs.	III. S.	35·48	..	..	..	35	35	All	H.	625	1·0	7½	0	2·207	0·453	..	..	..	⅜-in. at 200 yar		—
Gatling, 10 bar.	0·65-in.	787 lbs.	S. & L.	33·0	..	..	..	46·5	46·5	All	H.	270	0·65	0	1425	2·109	0·730	..	..	..	Not know	—	—
Gardner, 2 bar .	0·45-in.	131 lbs.	S. & L.	30·0	..	..	..	48·9	48·9	All	H.	85	0·450		480	2·952	0·751	..	..	..	Sam		

S., Sea-service gun; L., Land-service. The Roman numeral is the number of the pattern given.

* P means Polygroove; M.M., Maitland muzzle-loading, and M.B., Maitland breech-loading; Pl., Plain; W., Woolwich; F., French; F.M., French modified; H., Henry. † For the higher r given is for Palliser shot; for the lower natures it is for filled common shell. ‡ Estimated. § S.B.C. (in column for charge) means Slow-burning Cocoa; W.B.Pr., Westphali Prismatic Brown; Pb., Pebble; R.L.G., Rifle Large Grain; L.G., Large Grain.

th full charges).

AUSTRIAN NAVAL ORDNANCE.

		Krupp Steel B.L. Guns.										Armstrong.		Uchatius.			wrought
Designation by Calibre, in centimètres		30·5	28	26	24	24	21	15	15	15	12	23	18	15	9	7	15
Calibre, in inches		12·01	11·02	10·24	9·27	9·27	8·24	5·87	5·87	5·87	4·72	9·00	7·00	5·87	3·43	2·60	5·87
Length	Total, in Feet	35·11	20·01	18·77	17·16	15·45	13·73	17·13	12·63	12·63	13·8	13·00	10·83	12·19	6·76	3·28	10·13
	Rifled Portion, in inches	314·8	169·8	148·4	135·9	115·3	105·0	149·6	105·7	111·6	128·5	104·0	85·5	111·4	57·5	23·8	89·8
	Powder Chamber „	69·9	37·4	46·1	41·7	41·7	37·0	35·4	29·3	23·4	24·0	21·0	18·7	23·6	16·5	11·0	18·0
	Of bore in calibres	32·0	18·8	19·0	19·2	16·9	17·2	31·5	23·0	23·0	32·0	13·9	14·9	23·0	21·6	13·4	18·4
No. of Grooves		68	64	32	32	32	30	36	24	36	32	6	3	36	24	18	30
Twist in calibres		..	45	70	70	64·7	59	25	68·4	45	25	45	35	45	45	30	63·2
Weight	Gun, including Breech Gear, tons	47·8	27·1	21·7	14·6	14·5	8·68	4·69	3·94	3·94	2·25	12·50	6·50	3·35	0·479	0·09	2·81
	Breech Block, in lbs.	..	2315	1951	1411	1422	1080	..	321·9	321·9	..	..	..	209·4	55·1	18·7	176·4
	Steel Shell, in lbs.	1003·1	557·8	395·7	292·1	292·1	206·6	86·0	72·8	84·9	57·3	..	..	84·9	—	—	—
	Chilled Shell „	..	..	..	..	308·6	196·2	..	..	..	..	255·7	117·7	—	—	—	—
	Common Shell „	..	488·3	354·2	263·5	263·5	172·0	69·9	67·2 65·5	69·4	57·3	264·6	123·0	69·45	14·02 14·22	6·42	6·11
	Shrapnel Shell „	..	..	..	..	..	..	71·9	67·2 65·5	69·4	57·3	..	..	69·45	15·76	6·88	6·79
	Case Shot „	..	..	..	..	..	..	..	..	..	..	..	..	..	16·53	6·94	38·4
Weight of Bursting Charge	Steel Shell „	..	14·3	8·8	6·6	6·6	4·4	1·76	1·65	2·09	0·55	..	..	2·09	—	—	—
	Chilled Shell „	..	..	..	..	3·75	..	..	..	..	..	5·95	1·23	—	—	—	—
	Common Shell „	..	18·7	20·3	15·0	15·0	15·0	3·86	3·86	5·07	3·53	18·5	7·94	5·07	0·46	0·18	1·87
	Shrapnel Shell „	..	..	..	..	..	..	1·10	1·08	1·08	0·57	..	..	1·08	0·20	0·09	0·90
Weight of Firing Charge	Steel and Chilled Projectile, in lbs.	..	123·5*	95·9 B	76·1 B	52·9	50·7 C	38·8	21·6 C	20·9 C	19·8 B	50·7 P	28·7 P	20·9 C	—	—	—
	Common „ „ „	..	123·5*	59·5	44·1	44·1	30·9	38·8	14·3 21·6	20·9 C	19·8 B	30·9 O	13·2 O	20·9 C	3·31 0·97	0·77 O 0·35	4·74
	Exercising „ „ „	..	68·3	59·5	44·1	44·1	30·9	19·6	21·6 C	20·9 C	11·0	30·9 O	13·2 O	20·9 C	3·31	0·77 O 0·35	4·74
	Saluting „ „ „	..	19·8 O	19·8 O	15·4 O	15·4 O	8·82 O	4·74 O	4·74 O	4·74 O	..	15·4 O	8·8 O	4·74 O	0·88 O	0·35	4·74
Muzzle Velocity, in feet		..	1568	1404	1421	1378 1345	1519	1969	1641	1562	1738	1490	1522	1562	1470	978	1017
Muzzle Energy	Total, foot-tons	..	9513	5409	4087	3847	3306	2312	1358	1435	1201	3933	1891	1435	—	—	—
	Per inch circumference, foot-tons	..	270·4	168·2	140·4	132·1	127·7	125·4	73·7	77·9	81·0	140·4	87·0	77·9	—	—	—
Thickness of Iron, perforated inches at Muzzle		..	17·0	13·2	12·1	11·7	11·6	11·7	8·8	9·1	9·4	12·2	9·6	9·1	—	—	—

NOTE.—P stands for pebble powder; C for cube powder; *prismatic powder; O ordinary powder (inferior); B brown prismatic.

DANISH NAVAL ORDNANCE.

	Krupp B.L. Guns designated.										Armstrong M.L.						Fins-pong.
Designation by Calibre	35·5 cm.	30·5 cm.	26 cm. long.	26 cm. short.	15 cm. long.	15 cm. medium.	15 cm. short.	12 cm. long.	12 cm. short.	8·6 cm.	10 in.	10 in.	10 in.	9 in.	8 in.	8 in.	6 in.
Calibre, in inches	13·98	12·01	10·24	10·24	5·91	5·91	5·91	4·72	4·72	3·43	10·0	10 in.	10 in.	9·0	8·0	8 in.	6·04
Total length, in feet	29·1	22·0	32·8	18·77	17·1	12·63	10·7	11·8	9·6	6·9	17·0	14·5	14·0	13·0	10·8	10.8	9·5
Length of Bore, including Powder Chamber, in inches	304·7	227·2	327·6	194·5	190·3	135·0	112·9	128·8	102·4	73·6	175·5	145·5	140·0	125·0	104·2	104·2	100·8
Length of Bore, including Powder Chamber, in calibres	21·8	18·9	32·0	19·0	32·2	22·8	19·1	27·3	21·7	21·3	17·5	14·55	14·0	13·3	13·1	13·1	16·7
Number of Grooves	80	68	60	60	36	36	36	32	32	24	7	7	7	6	6	6	6
Twist of Rifling, in calibres	45	45	70·25	45	70·25	45	45	25	40	45	40	40	40	40	50	50	40
Total weight, including Breech-gear, tons	51·2	35·4	27·6	21·5	4·6	3·9	3·5	2.13	1·36	0·49	20·0	18·5	18·0	12·5	8·65	7·04	2·46
Weight of Breech Block, lbs.	4695·8	2910	1982	1940	390·2	330·7	324·1	229·2	176·4	101·4	—	—	—	—	—	—	—
Weight of Steel Shell, „	1157·4	725·3	451·9	451·9	112·4	—	—	—	—	—	—	—	—	—	—	—	—
Weight of Chilled Shell, „	1157·4	725·3	..	451·9	..	86·0	86·0	..	44·1	—	400	400	400	250·2	165·3	—	—
Weight of Common Shell, „	1157·4	621·7	451·9	391·3	112·4	69·4	69·4	57·3	36·2	14.3	400	400	400	250·2	131·2	—	55·1
Weight of Shrapnel Shell, „	..	..	—	..	—	..	—	—	..	..	..	—	—	..	149·9	—	15·4
Weight of Case Shot, „	..	..	—	..	—	..	—	—	..	..	191·8	—	—	154·3	127·9	—	58·4
Weight of Bursting Charge, Steel Shell, „	27·6	18·5	11·5	11·5	2·2	..	—	—	..	..	—	—	—	—	—	—	—
Weight of Bursting Charge, Chilled Shell, „	..	9·9	..	6·0	..	1·1	..	..	0·55	..	4·4	4·4	4.4	—	—	—	—
Weight of Bursting Charge, Common Shell, „	33·5	32·6	23·1	20·9	5·62	4·2	4·19	1·21	2·4	0·44	26·5	26·5	26·5	18·5	7·5	7·5	5·0
Weight of Firing Charge, Steel or Chilled Shell, lbs.	297·6	158·7	191·8	99·2	40·8	18·7	22·0	..	8·8	..	69·4	69·4	69·4	43·0	29·8	29·8	—
Weight of Firing Charge, Common Shell, „	297·6	158·7	191·8	99·2	40·8	18·7	22·0	18·2	8·8	3·3	69·4	69·4	69·4	34·2	19·8	19·8	60·6
Muzzle Velocity, Armour-piercing Projectile, feet	1619	1558	2064	1558	1789	1562	1542	..	1416	..	1457	1404	1388	1368	1378	1378	—
Muzzle Velocity, Common Shell, „	1619	1673	2064	1673	1789	1683	1690	..	1549	1457	1457	1404	1388	1214	1230	1230	1076
Muzzle Energy, Total foot-tons	20970	12200	13550	7605	2494	1455	1418	..	6130	..	5889	5467	5347	3244	2177	2177	—
Muzzle Energy, Per inch circumference, foot tons	477·5	323·5	421·4	236·4	134·4	78·4	73·0	..	32·8	..	189·0	175·8	171·6	115·8	86·9	86·9	—
Perforation at Muzzle, in inches	22·5	18·56	21·5	15·86	12·1	9·1	8·8	..	5·8	..	14·1	13·5	13·3	11·0	9·5	9·	—

DUTCH NAVAL ORDNANCE.

		Krupp Breech Loading.				Armstrong Muzzle Loading.			Dutch Breech Load.	full charges).	rought
esignation by Calibre, in centimètres		28	17	15	12 No. 1.	28	23	18	12 No. 2.	12 No. 3.	7·5
Calibre, in inches		11·02	6·80	5·87	4·72	11·00	9·00	7·00	4·72	4·72	2·95
Total Length, in feet		20·01	13·94	12·63	6·89	14·42	13·00	11·00	6·89	6·89	7·87
Length of Rifled Portion of bore, in inches		170·8	112·7	111·8	61·4	119·0	104·0	95·5	61·4	61·4	43·2
Length of Powder Chamber ,,		36·4	36·0	23·2	13·0	26·0	21·9	15·5	13·0	13·0	6·7
Length of bore, in Calibres		18·8	21·9	23·0	15·8	12·1	14·0	15·9	15·8	15·8	17·5
Number of Grooves		64	42	36	12	9	6	3	12		20
Depth of Grooves, inches		0·069	0·118	0·118	0·492	2·000	1·80	1·80	0·118		0·049
Total Weight, in tons		27·21	5·51	3·94	0·79	24·46	12·50	7·17	0·93	0·90	0·21
Firing Charge	Armour Piercing Projectile, in lbs.	121·3	27·6	20·9	..	86·0	50·7	30·0			—
	Common Shell ,,	121·3	27·6	20·9	2·43	86·0	50·7	13·9	2·43		0·82
Weight.	Armour-piercing Projectile ,,	560·0	132·3	86·0	41·0	533·5	249·1	114·6	—		—
	Common Shell ,,	476·2	112·4	69·4	29·5	535·7	262·4	116·8	29·5		9·5
	Case Shot ,,	273·4	63·9	41·9	26·5	185·2	149·9	68·3	26·5		9·3
Bursting Charge	Armour-piercing Projectile ,,	6·6	2·2	1·1	0·44	4·4	2·2	2·2	—		—
	Common Shell ,,	26·5	6·6	6·6	2·0	28·7	17·6	8·8	1·8		0·44
Muzzle Velocity, feet		1558	1558	1558	971	1332	1476	1558	951		958
Muzzle Energy	Total, in foot-tons	9423	2226	1447	..	6563	3763	1929	—		—
	Per inch Circumference, foot-tons	272	104	84	..	191	134	89	—		—
Perforation at Muzzle, in inches		17·0	10·5	9·1	..	14·0	11·9	9·7	—		—

FRENCH NAVAL ORDNANCE.

:	Pattern 1875.	Pattern 1884.	Pattern 1881.*	Pattern 1881.						Pattern 1875, and 1875 jacketed.						Pattern 1870, and 1870 jacketed.					Pattern 1870, and 1870 jacketed.				
Desig. by Calibre, in cms.	42	37	34 short.	16 heavy.	16 light.	14	10	9	6·5	34	27 jack'd.	27 I.	27 II.	10 jack'd.	10	32 jack'd.	32	27 jack'd.	27	24 jack'd.	19 jack'd.	16	14 jack'd.	9·0	6·5
Calibre, in inches	16·54	14·66	13·39	6·49	6·49	5.46	3·94	3·54	2·56	13·4	10·8	10·8	10·8	3·94	3·94	12·6	12·6	10·8	10·8	9·45	7·64	6·49	5·46	3·54	2·57
Total length, in feet	32·5	..	..	15·97	15·97	14·34	9·26	7·11	3·94	22·0	19·3	19·3	19·3	9·26	9·26	22·0	22·0	17·7	17·7	16·2	13·6	12·2	10·3	7·12	3·58
Length of Bore, in inches	366·0	..	..	180·9	180·9	162·6	102·6	77·9	41·18	241·5	213·4	213·4	213·6	104·3	104·3	243·6	243·6	194·3	194·3	179·1	151·0	187·3	115·0	78·0	38·4
Length of Bore, in calibres	22·1	..	..	27·9	27·9	30	26	22	16	18·0	19·8	19·8	19·8	26·5	26·5	19·5	19·5	18·0	18·0	19·0	19·8	21·2	21·1	22·0	15·0
Number of Grooves	84	..	..	50	50	42	30	28	20	68	54	54	42	20	20	64	64	54	54	48	38	50	28	36	26
Depth of Grooves	0·079	..	0·059	0·039	0·039	0·035	0·028	0·024	0·020	0·059	0·059	0·059	0·059	0·032	0·032	0·059	0·059	0·059	0·059	0·059	0·059	0·039	0·047	0·031	0·031
Rifling Twist	7°	..	..	7°	7°	7°	7°	7°	8°	4°	4°	4°	4°	7°	7°	4°	4°	4°	4°	4°	4°	7°	4°	7°	8°
Total weight, in tons	74·6	71	51·8	5·0	3·9	3·1	1·18	0·59	0·09	47·58	27·85	27·36	24·11	1·24	1·18	38·38	38·38	22·83	22·84	15·41	7·83	4·98	2·63	0·59	0·094
Weight of Firing Charge: Armour piercing projectile, lbs.	..	546	357·1	..	..	..	..	..	..	257·9	165·3	136·7	103·6	..	..	189·6	152·1	136·7	92·6	101·4	60·4	39·7	..	—	—
Common Shell „	..	..	..	..	..	..	..	..	..	231·5	145·5	121·3	103·6	10·1	7·1	172·0	152·1	126·8	92·6	92·6	..	39·7	13·6	3·62	0·90
Weight: Armour Piercing Projectile, lbs.	1984·2	1180	925·9	..	..	..	..	..	..	925·9	476·2	476·2	476·2	..	..	760·6	760·6	476·2	476·2	317·5	165·3	99·2	..	—	—
Common Shell „	..	..	..	..	..	..	..	..	..	771·6	396·8	396·8	396·8	30·9	26·5	631·6	631·6	396·8	396·8	264·6	137·8	99·2	61·7	17·6	5·95
Case Shot „	..	..	..	..	..	..	..	..	..	..	321·9	321·9	321·9	18·7	18·7	..	..	321·9	321·9	220·5	105·8	68·3	42·8	17·0	6·39
Muzzle Velocity, in feet, sec.	1739	1955	..	..	..	..	..	..	..	1595	1736	1641	1542	1673	1591	1542	1437	1575	1424	1624	1739	1782	1529	1493	1135
Muzzle Energy: Total, in foot-tons	41590	31272	24868	..	..	..	..	..	..	16320	9942	8865	7834	..	..	12540	10880	8191	6680	5794	3465	2183	..	—	—
Per in. circ., ft. tons	800	684	591	..	..	..	..	..	..	388	293	261	331	..	..	317	275	241	197	195	144	107	..	—	—
Perforation at Muzzle, ins.	29·4	27·4	25·5	..	..	..	..	..	..	20·3	17·8	16·7	15·6	..	..	18·3	16·9	16·0	14·3	14·4	12·5	10·8	..	—	—

* Details of other guns of the pattern 1881, have been communicated confidentially to the British Government, viz. 27-cm., 24-cm.

GERMAN NAVAL ORDNANCE.

		Krupp Steel Breech-loading Guns, designated by calibre.																								Bronze B.L.
Designation in centimètres		30·5 jack'd.	26 long.	26 jack'd.	26 short.	24 long.	24 short.	21 long.	21 long.	21 short.	21 short.	17 long.	17 short.	15 long.	15 short jack'd.	15 short.	15 short.	15 short jack'd.	15 short jack'd.	12·5 hoop'd.	12 hoop'd.	10·5 long.	8·7	8	8	8
Calibre, in inches		12·01	10·33	10·38	10·33	9·45	9·37	8·21	8·24	8·24	8·24	6·80	6·80	5·87	5·87	5·87	5·87	5·87	5·87	4·92	4·74	3·96	3·43	3·09	3·09	3·19
Length	Total, in feet	21·98	18·77	18·77	17·06	23·63	15·45	24·0	20·61	15·45	12·88	13·94	11·32	14·67	10·73	10·73	10·73	10·68	10·68	9·60	9·6	12·08	6·89	6·89	6·89	5·15
	Rifled portion, in ins.	181·9	149·8	150·0	129·3	201·6	116·2	218·2	176·5	124·6	114·9	117·1	102·2	128·5	93·3	87·1	86·7	87·1	86·7	85·7	85·3	113·6	62·7	57·6	57·6	45·9
	Powder Chamber "	45·3	44·7	44·4	44·7	53·5	40·9	75·3	46·7	37·1	34·0	31·5	16·7	31·1	19·0	25·1	25·5	25·1	25·5	16·7	16·7	19·5	10·7	10·5	10·5	9·73
	Bore, in calibres	18·9	18·8	18·8	16·8	26·1	16·8	35·6	27·1	19·6	18·1	21·9	17·5	27·2	19·1	19·1	19·1	19·1	19·1	20·8	21·6	33·6	21·4	22·0	22·0	17·4
Number of Grooves		72	86	48	36	56	48	48	48	30	30	30	30	36	36	36	24	36	24	32	18	32	24	12	12	12
Depth of Grooves, in inches		0·079	0·077	0·079	0·077	0·059	0·061	0·059	0·059	0·102	0·102	0·063	0·063	0·059	0·061	0·061	0·061	0·061	0·061	0·059	0·051	0·049	0·049	0·049	0·049	0·051
Twist, in calibres		45	50	50	50	25	45	25	25	68	59	45	45	25	45	45	68	50	65	40	60	25	40	46	46	46
Weight	Gun, including Breech Gear, tons	35·4	21·7	18·7	17·7	18·7	14·6	13·03	12·3	9·84	8·86	5·51	3·40	4·04	3·44	3·44	3·44	3·15	3·15	1·38	1·35	1·15	0·44	0·32	0·29	0·23
	Breech Block, in lbs.	2954	2050	1973	1973	..	1378	831·1	908·3	831·1	831·1	496·0	414·5	390·2	324·1	324·1	324·1	324·1	381·4	163·1	163·1	149·9	86·0	63·9	63·9	55·1
	Armour-piercing projectile, in lbs.	725·3	412·3	412·3	412·3	474·0	306·4	308·6	308·6	217·2	217·2	117·9	117·9	112·4	76·1	76·1	76·1	76·1	78·3	—	—	—	—	—	—	—
	Common Shells, in lbs.	725·3	357·1	357·1	357·1	474·0	261·5	308·6	308·6	174·2	174·2	112·9	112·9	112·4	65·0	65·0	65·0	63·0	61·1	40·1	38·1	39·7	14·9	9·4	9·4	8·3
Weight of Bursting Charge	Armour-piercing Shells, in lbs.	7·7	5·3	5·3	5·3	6·6	3·2	5·5	5·5	2·8	2·8	1·3	1·3	1·5	0·8	0·8	0·8	0·8	—	—	—	—	—	—	—	—
	Common Shells, in lbs.	19·8	14·3	14·3	22·0	15·4	15·4	12·1	12·1	6·6	6·6	5·1	5·1	4·3	4·2	4·2	4·2	4·2	..	2·4	2·5	0·9	0·4	0·4	0·6	0·6
Weight of Firing Charge	Armour-piercing Shells, in lbs.	202·8	105·8	105·8	125·7	152·1	67·2	103·6	103·6	41·9	35·3	30·9	16·5	33·1	14·3	17·1	13·2	17·1	13·2	—	—	—	—	—	—	—
	Common Shells, in lbs.	202·8	105·8	105·8	125·7	152.1	50·7	103·6	103·6	41·9	35·3	30·9	16·5	33·1	14·3	17·1	12·1	17·1	12·1	8·8	4·6	8·8	3·3	1·1	1·1	0·9
Initial Velocity	Armour-piercing projectile, feet-seconds.	1718	1588	1588	1578	1657	1493	1739	1657	1463	1316	1608	1326	1624	1463	1463	1358	1463	1358	—	—	—	—	—	—	—
	Common shell, ft.-sec.	1713	1641	1641	1654	1657	1391	1739	1657	1394	1276	1654	1342	1624	1555	1555	1447	1555	1447	1545	1280	1526	1545	1148	1119	1053
Muzzle Energy	Total, foot-tons	14,740	7211	7211	7119	9024	4736	6471	5876	3225	2606	2112	1436	2055	1131	1131	974	1131	1002	—	—	—	—	—	—	—
	Per inch circ., foot-tons	391	228	223	220	304	161	250·0	227	125	101	98·9	67·3	111·5	61·3	61·3	52·8	61·3	54·3	—	—	—	—	—	—	—
Perforation at Muzzle, in inches		20·5	15·4	15·4	15·3	18·1	13·0	16·4	15·6	11·4	10·1	10·3	8·3	11·0	8·0	8·0	7·4	8·0	7·5	—	—	—	—	—	—	—

NOTE.—See two 40-cm. Krupp L.S. guns, given on Col. Maitland's Table, p. 357, Annual 1886, viz. 71 tons and 119 tons weight.

ITALIAN NAVAL ORDNANCE.

		Armstrong Breech Loading.				B.L.	Armstrong Muzzle Loading.							Muzzle Loading. Old Pattern.		Breech Loading.	
Designation by Calibre, in centimètres		43 New Pattern.	43* Early Pattern. 1882.	15	12	12	45	28 New Pattern.	25 No. 1 Long.	25 No. 2 Short.	25 No. 2.	22	20	16	16	7·5 No. 1.	7·5 No. 2.
Calibre, in inches		17	17	59·1	4·72	4·7	17·72	11	10	10	10	9	8	7	7	3	3
Length	Total, in feet	40·75	39	13·8	8·5	9·25	32·7	14·4	14·4	14	13·8	13·8	10·8	11·8	10·6	5·8	3·3
	Rifled Bore, in inches	346·8	315·7	126	75	88	302	121	120	114	112	106	89	96	87	52	27
	Powder Chamber, in inches	84·5	98	28	10·8	22	56·5	24·5	26·0	26·0	14·0	19·5	15·7	21·3	21·3	10·2	7·9
	Bore, in Calibres	27	26	26	20·2	23·5	20·5	13·2	14·6	14·0	12·6	13·9	13·1	16·8	15·5	20·7	11·7
No. of Grooves		82	82	28	37	36	28	9	7	7	8	6	6	6	6	12	12
Twist of Rifling, in Calibres		50	50	40	40	42	50	35	40	40	55	45	45	42·5	27·3	48	48
Total Weight, in Tons		104·3	101·5	4	1·20	1·38	100	25·0	18·0	18·0	12·1	12·6	7·02	5·12	3·54	0·29	0·095
Firing Charge	Armour-piercing projectile, in lbs.	900·0	725	34	..	..	551	94·8	77·2		63·9	50·0	35·0	19·8	—	—	—
	Common shell „	600	480	25	5·5	9·3	440·9	66·1	52·9		41·9	33·0	21·0	7·1	7·1	1·9	0·7
Weight.	Armour-piercing projectile, in lbs.	2000	2000	80	..	..	2000	560·0	451·9		331·8	250·0	180·0	101·4	—	—	—
	Common Shell, in lbs.	2000	2000	80	31·7	36·4	2000	533·5	399·0		284·4	250·0	180·0	66·1		91·7	93·0
	Shrapnel, in lbs.	2000	2000	80	31·7	37·37	2000	533·5	399·0		284·4	250·0	180·0	66·1		91·7	93·0
	Case Shot „	2000	2000	70	23·5	35·9	2000	200·1	188·1		135·6	99·6	79·4	33·1		64·6	64·6
Bursting Charge	Armour-piercing projectile, in lbs.	32	32	1·5	..	..	32	15·0	11·1		8·4	6·3	3·6	--		—	—
	Common Shell, in lbs.	60	60	5	3·1	2·2	78	26·0	23·8		18·2	18·8	9·7	2·8		0·3	0·4
	Shrapnel „	5	5	0·16	0·28	0·35	5	2·2	1·85		1·96	1·48	0·71	0·50		0·02	0·02
Muzzle Velocity, in feet		1992	1935	1946	1394	1591	1700	1329	1388		1373	1412	1353	1303	1024	1335	—
Muzzle Energy	Total, foot-tons	55,030	51,930	2100	..	..	40,060	6859	6035		4369	36,040	22,850	1195	—	—	—
	Per inch circumference, foot-tons	1035	976·3	114.1	..	..	753·4	198·6	192·2		139·1	128·6	99·8	54·4	—	—	—
Perforation at Muzzle, inches		33·7	32·8	11·2	..	..	28·5	14·2	14·1		12·0	11·5	10·1	7·5	—	--	—

* At Spezia Grüson shield trial (see p. 321, Annual 1886) the projectile weighed 2204·6 lbs. (100 kg.). The charge was 826·7 lbs. Cologne prismatic powder. The muzzle velocity was about 1775 feet, and muzzle energy 48,184.

RUSSIAN NAVAL ORDNANCE.

	Obuchoff Steel Breech Loading Hooped Guns.											Steel B.L. Guns.		
Designation by Calibre, in inches	12 Long.	12	11	11 Pattern 77.	9	9	8	6 Long.	6 03	6	Long 9-pdr.	4·2 (9-pdr.)	3·43 Long (4-pdr.)	3·43 (4-pdr.)
Calibre in centimètres	30·48	30·48	27·94	27·94	22·86	22·86	20·32	15·24	15·32	15·24	10·67	10·67	8·70	8·70
Total Length, in feet	30	20	18·3	20·0	15·0	13	14·6	14	12·2	11·7	6·9	7·0	6·9	5·8
Length of Rifled Portion of Bore, in inches	..	165·0	152·0	158·0	124·0	..	128·0	118·7	106 0	98·0	61·5	65·0	62·6	53·0
Length of Powder Chamber „	..	38·5	35·0	50·4	28·5	..	23·0	30·5	22·4	22·2	10·5	8·0	10·7	—
Length of Bore in calibres, including Powder Chamber	..	17	17	18·9	16·9	..	18·9	24·9	21·3	20	17·1	17·4	21·4	—
Number of Grooves, in inches	..	36	36	64	32	32	30	..	24	24	24	16	24	12
Depth of Grooves „	0·070	0·135	0·135	0·135	0·110	0·110	0·090	0·060	0·085	0·070	0·055	0·055	0·050	0·050
Twist of Rifling in calibres	..	73·5	70	..	60	60	70	*24	60	68	*40	50	40	41
Total Weight, in tons	50·45	39·9	28·2	28·2	15·0	12·5	9·67	4·07	4·35	4·03	0·60	0·87	0·45	0·35
Weight of Steel Shell, in lbs.	..	665·8	515·9	..	249·1	275·6	172·0	..	97·6	86·0	—	—	—	—
Chilled Shell, „	731·9	665·8	515·9	562·2	275·6	264·7	169·8	119·0	86·0	86·0	—	—	—	—
Common Shell, „	..	639·3	496·0	520·3	266·8	266·8	172·0	..	81·6	81·6	27·6	24·2	15·2	12·6
Case Shot, „	..	293·2	216·1	..	176·4	176 4	134·5	..	57·3	57·3	27·6	22·3	15·2	11·0
Weight of Firing Charge. Steel Shell, „	..	144 4	115·3	..	64·2	47 0	31·5	..	14·3	18·1	—	—	—	—
Chilled Shell, „	216·9	144·6	90·6	132 2	47·0	47·0	29·3	37·5	14·3	18·1	—	—	—	—
Common Shell, „	..	117·3	81·6	132·2	42·1	42·1	28·4	..	10·8	14·3	4·5	2·6	3·1	1·3
Muzzle Velocity, in feet	1942	1470	1486	1516	1463	1260	1352	..	1206	1463	—	—	—	—
Muzzle Energy Total, foot-tons	19140	9965	7905	8999	3701	3035	2180	..	982	1276	—	—	—	—
Per Inch Circumference, foot-tons	508·4	264·5	229·4	260·4	030·9	107·4	86·7	..	51·8	67·74	—	—	—	—
Perforation † at Muzzle, in inches	23·6	16·7	15·5	16·6	11·7	10·5	9·5	..	7·2	8·4	—	—	—	—

* Maximum of increasing twist. † Through iron unbacked.

SPANISH NAVAL ORDNANCE.

		Hontoria, New Pattern.					Hontoria, Pattern 83.						Armstrong, Pattern 83.						Armstrong.			Krupp.				
		Breech Loading.					Breech Loading.												Muzzle Loading.		Pattrn. 81 B.L.	Breech Loading.				
Designation by Calibre . .		16-cm No. 1.	16-cm	12-cm.	9-cm.	7-cm.	32-cm	28-cm.	24-cm.	20-cm.	16-cm.	12-cm.	24-cm.	20·3-cm	15-cm.	12-cm.	8·4-cm	7·5-cm long.	22·86-cm	20·3-cm	6-in.	15-cm.	12-cm.	8·7-cm	7·5-cm	7·5-cm short.
Calibre, in inches . . .		6·34	6·34	4·72	3·54	2·76	12·60	11·02	9·45	7·87	6·34	4·72	9·449	8·00	6·00	4·72	3 3	2·95	9·00	8·00	6·00	5·87	4·72	3·43	2·95	2·95
Length	Total length, in feet	13·8	9·63	10·4	7·8	3·7	38·7	33·8	..	..	19·3	14·5	29	18·4	17·00	13·75	7·9	7·51	13·0	11·9	14·5	17·13	11·81	6·9	6·3	3·22
	Rifled Portion, in inches	125·6	89·8	94·5	70·9	35·4	352·4	309·1	..	..	170·9	135·8	260·2	162·0	158·3	135·8	75 0	70·7	104·0	102·0	126·9	..	..	..	57·6	—
	Powder Chamber, in inches	31·9	17·3	23·8	17·7	6·1	..	..	..	..	..	..	66·9	43·5	31·4	19	13	13	..	..	29·7	—	—	—	—	—
	Bore, in calibres.	25	16·9	25	25	15	36*	36*	..	..	36*	37*	35	26	32	33	27	28·7	14	14·75	26·1	35*	30*	24*	25·8*	13*
No. of Grooves		38	38	30	22	18	80	70	60	50	40	30	60	33	28	22	20	18	6	4	28	36	32	24	24	24
Depth of Grooves, in inches.		0·59	0·59	0·49	0·49	0·49	0·59	0·59	0·59	0·59	0·59	0·49	0·49	0·025	0·037	0·03	0·03	0·03	0·18	0·18	..	0·59	0·59	0·49	0·49	0·49
Twist of Rifling, in calibres.		Increasing from 100 to 49.	56	Increasing from 100 to 40.			From 0 to 30.						30	45	30	40	30	35	45	40	100 to 40	25	25	40	36	25
Total Weight, in tons . .		5·6	2·71	1·4	0·59	0·10	48·2	32·5	19·8	11·5	6·1	2·6	21	11·5	5·0	2·2	0·45	0·35	12·5	9·0	4·0	4·6	2·1	0·49	0·30	0·09
Weight	Armour-piercing projectile, in lbs	93·7	..	..	..	..	1058	727·5	440·9	253·5	132·3	55·1	415	180	100·0	40·0	..	..	2500	180·0	78·0	85·10	43·65	—	—	—
	Common Shell, in lbs.	83·8	63·9	36·2	15·4	7·28	..	..	..	..	116·8	49·6	393	180	100·0	40·0	15·0	12·0	2500	180 0	83·6	65·70	34·61	14·6	9·48	9·48
	Ring Segment, in lbs.	83·8	..	33·1	17·0	7·9	..	..	..	..	116·8	49·6	..	..	..	40·0	15·0	12·0	..	..	..	..	31·61	14·6	9.04	9·04
Firing Charge	Armour-piercing projectile, in lbs.	26·5	..	..	..	..	..	..	..	..	..	..	220	90	55·0	16·0	..	..	50·0	35·0	34·0	37·48	19·29	—	—	—
	Other projectiles	24·3	15·4	13·2	6·28	0·99	..	..	..	..	..	..	145	65	34·0	12·0	4·0	3·75	33·0	21·0	39·0	..	..	10·3	10·4	—
Muzzle Velocity, in feet .		1631	1493	1749	1837	1037	..	..	..	..	..	..	1950	2020	2070	2000	1625	1709	..	..	1936	2182	2034	1539	1542	961
Muzzle Energy	Total, in foot-tons	1729	988	702	..	..	..	..	..	..	..	..	11730	5094	2972	1109	275	243	..	..	2173	2809	1252	—	—	—
	Per inch circumference, foot-tons	87·4	..	..	..	..	..	..	..	..	..	..	397·4	203·8	156·4	75·15	..	..	..	..	..	152·4	84·45	—	—	—
Perforation at Muzzle, in inches		9·6	..	..	..	..	..	..	..	..	..	..	20·9	15·0	13·22	9·09	..	..	..	..	..	12·9	9·63	—	—	—

NAVAL ORDNANCE OF SWEDEN AND NORWAY.

		SWEDEN.				NORWAY.								
		Breech Loaders.			M.L.	Krupp, Hooped B.L.		Armstrong, M.L.				Palliser, M.L.		Cast-iron, M.L.
Designation by Calibre		27-cm.	24-cm.	17-cm.	12-cm.	26-cm.	15-cm.	8½-in.	8½-in.	8½-in.	6½-in.	5½-in.	5-in.	5-in.
Calibre, inches		10·80	9·45	6·58	4·80	10·24	5·91	10·51	10·51	10·51	7·88	6·58	6·11	6·11
Total Length, feet		17·46	14·96	11·27	8·87	18·77	12·63	16·87	14·66	13·49	10·82	11·58	10·30	11·21
Length	Rifled Portion of Bore in inches	161·8	138·0	108·6	83·3	160·4	112·4	137·3	121·0	110·6	85·7	92·4	91·7	101·6
	Chamber, "	30·0	26·7	16·8	13·6	34·1	22·6	38·2	24·0	20·5	18·5	19·3	10·8	14·5
	Bore in calibres, "	17·8	17·4	19·1	20·2	19·0	22·8	16·7	13·8	12·5	13·2	17·0	16·8	19·0
Number of Grooves		5	5	5	8	60	36	8	8	8	6	3	3	3
Twist of Rifling		..	30	..	40	45	45	55	55	55	50	34	34	34
Total Weight, tons		23·9	14·4	5·2	1·9	21·7	3·9	21·4	19·5	18·1	7·5	4·8	3·4	2·9
Weight of	Chilled Shell, lbs.	476·2	317·5	108·0	..	463·0	86·0	447·5	385·8	385·8	153·2	110·2	—	—
	Common Shell, "	396·8	224·9	76·3	34·6	381·4	69·4	308·6	308·6	308·6	148·8	82·7	59·1	59·1
Weight of Firing Charge	Chilled Shell, lbs.	98·1	59·5	23·4	..	99·2	18·7	121·3	71·7	66·1	29·7	22·0	—	—
	Common Shell, "	66·1	37·5	17·6	6·6	81·6	18·7	77·2	38·6	88·6	19·8	11·0	7·17	7·17
Muzzle Velocity, feet		1365	1322	1378	..	1575	1575	1555	1378	1296	1296	1329	—	—
Total foot-tons		6152	3848	1422	..	7966	1479	7502	5082	4495	1785	1350	—	—
Muzzle Energy	Per inch Circumference	179·6	129·6	68·8	..	247·7	79·7	227·3	153·9	136·1	72·1	65·3	—	—
	Perforation through Iron	13·65	11·5	8·4	..	16·2	9·2	15·6	12·6	11·8	8·6	8·2	—	—

UNITED STATES—NAVAL ORDNANCE.

Supplied by Lieut. Jacques, U.S. Navy.

Forged Steel, built up B.-L. Guns.

NAME OF GUN.		Length of Gun.							Weight of Projectiles.		Charge.				
	Calibre.	Total Length.	Length of Bore.		Rifled Portion.	Powder Chamber.	Twist of Rifling.	Total Weight.	Armour Piercing.	Common.	Firing.	Bursting.	Initial Velocity.	Muzzle Energy.	Perforation of Wrought Iron at Muzzle.
	inch.	inch.	inch.	Cal.	inch.	inch.		tons.	lbs.	lbs.	lbs.	lbs. or oz.	ft. per sec.	ft.-tons.	inch.
Finished.															
5-in. B.L.R.	5	162·0	152	30·6	120·75	29·2	1 turn in 30 cals.*	2·77	60	60	30	3	1960	1,599	10·6
6-in. B.L.R.	6	196	185·75	31·12	144·26	40·49		4·58	100	100	50	6	2105	3,072	13·4
8-in. B.L.R.	8	257·99	242·46	30·43	194·16	49·61		12·53	250	250	125	13	2050	7,286	17·8
10-in. B.L.R.	10	329·10	310·22	31·02	246·26	60·96		26	500	500	250	22	2100	15,290	23·1
Under Construction.															
8-in. B.L.R.	8	264·5	248·97	31·25	195·80	53·21		11·48	250	250	125	13	2100	7,643	18·3
10-in. B.L.R.	10	329·1	310·22	31·02	246·26	60·96		26·0	500	500	250	22	2100	15,290	23·1
10½-in. B L.R.	10½	368·6	350·0	33·3	281·8	69·0		29·0	550	550	275	24	2100	16,813	23·7
Forgings contracted for.†															
12-in. B.L.R.	12	422·6	400·12	33·42	319·81	79·31		47·0	850	850	425	38	2100	25,984	27·6

* Rifling polygroove, increasing twist. In the 8-inch Rifle, from 1 in 180 to 1 in 30 calibres at 13 inches from muzzle, then uniform.

† The 12-inch, as well as 6, 8, and 10-inch guns are to be finished in the Naval Ordnance Factory, Washington; 16-inch guns of 109 tons and 150 tons are designed.

AUSTRIAN NAVAL ORDNANCE.

th full charges).

		Krupp Steel B.L. Guns.										Armstrong.		Uchatius.			wrought
Designation by Calibre, in centimètres		30·5	28	26	24	24	21	15	15	15	12	23	18	15	9	7	15
Calibre, in inches		12·01	11·02	10·24	9·27	9·27	8·24	5·87	5·87	5·87	4·72	9·00	7·00	5·87	3·43	2·60	5·87
Length	Total, in Feet	35·11	20·01	18·77	17·16	15·45	13·73	17·13	12·63	12·63	13·8	13·00	10·83	12·19	6·76	3·28	10·13
	Rifled Portion, in inches	314·8	169·8	148·4	135·9	115·3	105·0	149·6	105·7	111·6	128·5	104·0	85·5	111·4	57·5	23·8	89·8
	Powder Chamber "	69·9	37·4	46·1	41·7	41·7	37·0	35·4	29·3	23·4	24·0	21·0	18·7	23·6	16·5	11·0	18·0
	Of bore in calibres	32·0	18·8	19·0	19·2	16·9	17·2	31·5	23·0	23·0	32·0	13·9	14·9	23·0	21·6	13·4	18·4
No. of Grooves		68	64	32	32	32	30	36	24	36	32	6	3	36	24	18	30
Twist in calibres		..	45	70	70	64·7	59	25	68·4	45	25	45	35	45	45	30	63·2
Weight	Gun, including Breech Gear, tons	47·8	27·1	21·7	14·6	14·5	8·68	4·69	3·94	3·94	2·25	12·50	6·50	3·35	0·479	0·09	2·81
	Breech Block, in lbs.	..	2315	1951	1411	1422	1080	..	321·9	321·9	..	..	..	209·4	55·1	18·7	176·4
	Steel Shell, in lbs.	1003·1	557·8	395·7	292·1	292·1	206·6	86·0	72·8	84·9	57·3	..	..	84·9	—	—	—
	Chilled Shell "	..	..	..	..	308·6	196·2	..	..	..	..	255·7	117·7	—	—	—	—
	Common Shell "	..	488·3	354·2	263·5	263·5	172·0	69·9	67·2/65·5	69·4	57·3	264·6	123·0	69·45	14·02/14·22	6·42	6·11
	Shrapnel Shell "	..	..	..	..	..	..	71·9	67·2/65·5	69·4	57·3	..	..	69·45	15·76	6·88	6·79
	Case Shot "	..	..	..	..	..	..	..	..	..	..	..	..	..	16·53	6·94	38·4
Weight of Bursting Charge	Steel Shell "	..	14·3	8·8	6·6	6·6	4·4	1·76	1·65	2·09	0·55	..	..	2·09	—	—	—
	Chilled Shell "	..	..	..	..	3·75	..	..	..	..	..	5·95	1·23	—	—	—	—
	Common Shell "	..	18·7	20·3	15·0	15·0	15·0	3.86	3·86	5·07	3·53	18·5	7·94	5·07	0·46	0·18	1·87
	Shrapnel Shell "	..	..	..	..	..	..	1·10	1·08	1·08	0·57	..	..	1·08	0·20	0·09	0·90
Weight of Firing Charge	Steel and Chilled Projectile, in lbs.	..	123·5*	95·9 B	76·1 B	52·9	50·7 C	38·8	21·6 C	20·9 C	19·8 B	50·7 P	28·7 P	20·9 C	—	—	—
	Common " " "	..	123·5*	59·5	44·1	44·1	30·9	38·8	14·3/21·6	20·9 C	19·8 B	30·9 O	13·2 O	20·9 C	3·31/0·97	0·77 O/0·35	4·74
	Exercising " " "	..	68·3	59·5	44·1	44·1	30·9	19·6	21·6 C	20·9 C	11·0	30·9 O	13·2 O	20·9 C	3·31	0·77 O/0·35	4·74
	Saluting " " "	..	19·8 O	19·8 O	15·4 O	15·4 O	8·82 O	4·74 O	4·74 O	4·74 O	..	15·4 O	8·8 O	4·74 O	0·88 O	0·35	4·74
Muzzle Velocity, in feet		..	1568	1404	1421	1378/1345	1519	1969	1641	1562	1738	1490	1522	1562	1470	978	1017
Muzzle Energy	Total, foot-tons	..	9513	5409	4087	3847	3306	2312	1358	1435	1201	3933	1891	1435	—	—	—
	Per inch circumference, foot-tons	..	270·4	168·2	140·4	132·1	127·7	125·4	73·7	77·9	81·0	140·4	87·0	77·9	—	—	—
Thickness of Iron, perforated inches at Muzzle		..	17·0	13·2	12·1	11·7	11·6	11·7	8·8	9·1	9·4	12·2	9·6	9·1	—	—	—

NOTE.—P stands for pebble powder; C for cube powder; *prismatic powder; O ordinary powder (inferior); B brown prismatic.

DANISH NAVAL ORDNANCE.

		Krupp B.L. Guns designated.										Armstrong M.L.						Finspong.
Designation by Calibre		35·5 cm.	30·5 cm.	26 cm. long.	26 cm. short.	15 cm. long.	15 cm. medium.	15 cm. short.	12 cm. long.	12 cm. short.	8·6 cm.	10 in.	10 in.	10 in.	9 in.	8 in.	8 in.	6 in.
Calibre, in inches		13·98	12·01	10·24	10·24	5·91	5·91	5·91	4·72	4·72	3·43	10·0	10 in.	10 in.	9·0	8·0	8 in.	6·04
Total length, in feet		29·1	22·0	32·8	18·77	17·1	12·63	10·7	11·8	9·6	6·9	17·0	14·5	14·0	18·0	10·8	10.8	9·5
Length of Bore, including Powder Chamber	in inches	304·7	227·2	327·6	194·5	190·3	135·0	112·9	128·8	102·4	73·6	175·5	145·5	140·0	125·0	104·2	104·2	100·8
	in calibres	21·8	18·9	32·0	19·0	32·2	22·8	19·1	27·3	21·7	21·3	17·5	14·55	14·0	13·3	13·1	13·1	16·7
Number of Grooves		80	68	60	60	36	36	36	32	32	24	7	7	7	6	6	6	6
Twist of Rifling, in calibres		45	45	70·25	45	70·25	45	45	25	40	45	40	40	40	40	50	50	40
Total weight, including Breech-gear, tons		51·2	35·4	27·6	21·5	4·6	3·9	3·5	2.13	1·36	0·49	20·0	18·5	18·0	12·5	8·65	7·04	2·46
Weight of	Breech Block, lbs.	4695·8	2910	1982	1940	390·2	330·7	324·1	229·2	176·4	101·4	—	—	—	—	—	—	—
	Steel Shell, „	1157·4	725·3	451·9	451·9	112·4	—	—	—	—	—	—	—	—	—	—	—	—
	Chilled Shell, „	1157·4	725·3	..	451·9	..	86·0	86·0	..	44·1	—	400	400	400	250·2	165·3	—	—
	Common Shell, „	1157·4	621·7	451·9	391·3	112·4	69·4	69·4	57·3	36·2	14.3	400	400	400	250·2	131·2	—	55·1
	Shrapnel Shell, „	..	..	—	..	—	..	—	—	..	..	..	—	—	..	149·9	—	15·4
	Case Shot, „	..	..	—	..	—	..	—	—	..	..	191·8	—	—	154·3	127·9	—	58·4
Weight of Bursting Charge	Steel Shell, „	27·6	18·5	11·5	11·5	2·2	..	—	—	..	..	—	—	—	—	—	—	—
	Chilled Shell, „	..	9·9	..	6·0	..	1·1	..	..	0·55	..	4·4	4·4	4.4	—	—	—	—
	Common Shell, „	33·5	32·6	23·1	20·9	5·62	4·2	4·19	1·21	2·4	0·44	26·5	26·5	26·5	18·5	7·5	7·5	5·0
Weight of Firing Charge	Steel or Chilled Shell, lbs.	297·6	158·7	191·8	99·2	40·8	18·7	22·0	..	8·8	..	69·4	69·4	69·4	43·0	29·8	29·8	—
	Common Shell, „	297·6	158·7	191·8	99·2	40·8	18·7	22·0	18·2	8·8	3·3	69·4	69·4	69·4	34·2	19·8	19·8	60·6
Muzzle Velocity	Armour-piercing Projectile, feet	1619	1558	2064	1558	1789	1562	1542	..	1416	..	1457	1404	1388	1368	1378	1378	—
	Common Shell, „	1619	1673	2064	1673	1789	1683	1690	..	1549	1457	1457	1404	1388	1214	1230	1230	1076
Muzzle Energy	Total foot-tons	20970	12200	13550	7605	2494	1455	1418	..	6130	..	5889	5467	5347	3244	2177	2177	—
	Per inch circumference, foot tons	477·5	323·5	421·4	236·4	134·4	78·4	73·0	..	32·8	..	189·0	175·8	171·6	115·8	86·9	86·9	—
Perforation at Muzzle, in inches		22·5	18·56	21·5	15·86	12·1	9·1	8·8	..	5·8	..	14·1	13·5	13·3	11·0	9·5	9·5	—

DUTCH NAVAL ORDNANCE.

		Krupp Breech Loading.				Armstrong Muzzle Loading.			Dutch Breech Load.. full charges).		
											rought
Designation by Calibre, in centimètres		28	17	15	12 No. 1.	28	23	18	12 No. 2.	12 No. 3.	7·5
Calibre, in inches		11·02	6·80	5·87	4·72	11·00	9·00	7·00	4·72	4·72	2·95
Total Length, in feet		20·01	13·94	12·63	6·89	14·42	13·00	11·00	6·89	6·89	7·87
Length of Rifled Portion of bore, in inches		170·8	112·7	111·8	61·4	119·0	104·0	95·5	61·4	61·4	43·2
Length of Powder Chamber "		36·4	36·0	23·2	13·0	26·0	21·9	15·5	13·0	13·0	6·7
Length of bore, in Calibres		18·8	21·9	23·0	15·8	12·1	14·0	15·9	15·8	15·8	17·5
Number of Grooves		64	42	36	12	9	6	3	12		20
Depth of Grooves, inches		0·069	0·118	0·118	0·492	2·000	1·80	1·80	0·118		0·049
Total Weight, in tons		27·21	5·51	3·94	0·79	24·46	12·50	7·17	0·93	0·90	0·21
Firing Charge	Armour Piercing Projectile, in lbs.	121·3	27·6	20·9	..	86·0	50·7	30·0			—
	Common Shell "	121·3	27·6	20·9	2·43	86·0	50·7	13·9	2·43		0·82
Weight.	Armour-piercing Projectile "	560·0	132·3	86·0	41·0	533·5	249·1	114·6	—		—
	Common Shell "	476·2	112·4	69·4	29·5	535·7	262·4	116·8	29·5		9·5
	Case Shot "	273·4	63·9	41·9	26·5	185·2	149·9	68·3	26·5		9·3
Bursting Charge	Armour-piercing Projectile "	6·6	2·2	1·1	0·44	4·4	2·2	2·2	—		—
	Common Shell "	26·5	6·6	6·6	2·0	28·7	17·6	8·8	1·8		0·44
Muzzle Velocity, feet		1558	1558	1558	971	1332	1476	1558	951		958
Muzzle Energy	Total, in foot-tons	9423	2226	1447	..	6563	3763	1929	—		—
	Per inch Circumference, foot-tons	272	104	84	..	191	134	89	—		—
Perforation at Muzzle, in inches		17·0	10·5	9·1	..	14·0	11·9	9·7	—		—

FRENCH NAVAL ORDNANCE.

	Pattern 1875.	Pattern 1884.	Pattern 1881.*	Pattern 1881.						Pattern 1875, and 1875 Jacketed.						Pattern 1870, and 1870 Jacketed.					Pattern 1870, and 1870 Jacketed.				
Desig. by Calibre, in cms.	42	37	34 short.	16 heavy.	16 light.	14	10	9	6·5	34	27 jack'd.	27 I.	27 II.	10 jack'd.	10	32 jack'd.	32	27 jack'd.	27	24 jack'd.	19 jack'd.	16	14 jack'd.	9·0	6·5
Calibre, in inches	16·54	14·66	13·39	6·49	6·49	5.46	3·94	3·54	2·56	13·4	10·8	10·8	10·8	3·94	3·94	12·6	12·6	10·8	10·8	9·45	7·64	6·49	5·46	3·54	2·57
Total length, in feet	32·5	..	..	15·97	15·97	14·34	9·26	7·11	3·94	22·0	19·3	19·3	19·3	9·26	9·26	22·0	22·0	17·7	17·7	16·2	13·6	12·2	10·3	7·12	3·58
Length of Bore, in inches	366·0	..	..	180·9	180·9	162·6	102·6	77·9	41·18	241·5	213·4	213·4	213·6	104·3	104·3	243·6	243·6	194·3	194·3	179·1	151·0	187·3	115·0	78·0	38·4
Length of Bore, in calibres	22·1	..	..	27·9	27·9	30	26	22	16	18·0	19·8	19·8	19·8	26·5	26·5	19·5	19·5	18·0	18·0	19·0	19·8	21·2	21·1	22·0	15·0
Number of Grooves	84	..	..	50	50	42	30	28	20	68	54	54	42	20	20	64	64	54	54	48	38	50	28	36	26
Depth of Grooves	0·079	..	0·059	0·039	0·039	0·035	0·028	0·024	0·020	0·059	0·059	0·059	0·059	0·032	0·032	0·059	0·059	0·059	0·059	0·059	0·059	0·039	0·047	0·031	0·031
Rifling Twist	7°	..	..	7°	7°	7°	7°	7°	8°	4°	4°	4°	4°	7°	7°	4°	4°	4°	4°	4°	4°	7°	4°	7°	8°
Total weight, in tons	74·6	71	51·8	5·0	3·9	3·1	1·18	0·59	0·09	47·58	27·85	27·36	24·11	1·24	1·18	38·38	38·38	22·83	22·84	15·41	7·83	4·98	2·63	0·59	0·094
Weight of Firing Charge: Armour piercing projectile, lbs.	..	546	357·1	..	..	..	..	..	..	257·9	165·3	136·7	103·6	..	..	189·6	152·1	136·7	92·6	101·4	60·4	39·7	..	—	—
Common Shell „	..	..	..	..	..	..	..	..	..	231·5	145·5	121·3	103·6	10·1	7·1	172·0	152·1	126·8	92·6	92·6	..	39·7	13·6	3·62	0·90
Weight: Armour Piercing Projectile, lbs.	1984·2	1180	925·9	..	..	..	..	..	..	925·9	476·2	476·2	476·2	..	..	760·6	760·6	476·2	476·2	317·5	165·3	99·2	..	—	—
Common Shell „	..	..	..	..	..	..	..	..	..	771·6	396·8	396·8	396·8	30·9	26·5	631·6	631·6	396·8	396·8	264·6	137·8	99·2	61·7	17·6	5·95
Case Shot „	..	..	..	..	..	..	..	..	..	..	321·9	321·9	321·9	18·7	18·7	..	..	321·9	321·9	220·5	105·8	68·3	42·8	17·0	6·39
Muzzle Velocity, in feet, sec.	1739	1955	..	..	..	..	..	..	..	1595	1736	1641	1542	1673	1591	1542	1437	1575	1424	1624	1739	1782	1529	1493	1135
Muzzle Energy: Total, in foot-tons	41590	31272	24868	..	..	..	..	..	..	16320	9942	8865	7834	..	..	12540	10880	8191	6680	5794	3465	2183	..	—	—
Per in. circ., ft. tons	800	684	591	..	..	..	..	..	..	388	293	261	331	..	..	317	275	241	197	195	144	107	..	—	—
Perforation at Muzzle, ins.	29·4	27·4	25·5	..	..	..	..	..	..	20·3	17·8	16·7	15·6	..	..	18·3	16·9	16·0	14·3	14·4	12·5	10·8	..	—	—

* Details of other guns of the pattern 1881, have been communicated confidentially to the British Government, viz. 27-cm., 24-cm.

DUTCH NAVAL ORDNANCE.

	Krupp Breech Loading.				Armstrong Muzzle Loading.			Dutch Breech Load. h full charges).		rought
Designation by Calibre, in centimètres	28	17	15	12 No. 1.	28	23	18	12 No. 2.	12 No. 3.	7·5
Calibre, in inches	11·02	6·80	5·87	4·72	11·00	9·00	7·00	4·72	4·72	2·95
Total Length, in feet	20·01	13·94	12·63	6·89	14·42	13·00	11·00	6·89	6·89	7·87
Length of Rifled Portion of bore, in inches	170·8	112·7	111·8	61·4	119·0	104·0	95·5	61·4	61·4	43·2
Length of Powder Chamber ,,	36·4	36·0	23·2	13·0	26·0	21·9	15·5	13·0	13·0	6·7
Length of bore, in Calibres	18·8	21·9	23·0	15·8	12·1	14·0	15·9	15·8	15·8	17·5
Number of Grooves	64	42	36	12	9	6	3	12		20
Depth of Grooves, inches	0·069	0·118	0·118	0·492	2·000	1·80	1·80	0·118		0·049
Total Weight, in tons	27·21	5·51	3·94	0·79	24·46	12·50	7·17	0·93	0·90	0·21
Firing Charge: Armour Piercing Projectile, in lbs.	121·3	27·6	20·9	..	86·0	50·7	30·0			—
Firing Charge: Common Shell ,,	121·3	27·6	20·9	2·43	86·0	50·7	13·9	2·43		0·82
Weight: Armour-piercing Projectile ,,	560·0	132·3	86·0	41·0	533·5	249·1	114·6	—		—
Weight: Common Shell ,,	476·2	112·4	69·4	29·5	535·7	262·4	116·8	29·5		9·5
Weight: Case Shot ,,	273·4	63·9	41·9	26·5	185·2	149·9	68·3	26·5		9·3
Bursting Charge: Armour-piercing Projectile ,,	6·6	2·2	1·1	0·44	4·4	2·2	2·2	—		—
Bursting Charge: Common Shell ,,	26·5	6·6	6·6	2·0	28·7	17·6	8·8	1·8		0·44
Muzzle Velocity, feet	1558	1558	1558	971	1332	1476	1558	951		958
Muzzle Energy: Total, in foot-tons	9423	2226	1447	..	6563	3763	1929	—		—
Muzzle Energy: Per inch Circumference, foot-tons	272	104	84	..	191	134	89	—		—
Perforation at Muzzle, in inches	17·0	10·5	9·1	..	14·0	11·9	9·7	—		—

FRENCH NAVAL ORDNANCE.

	Pattern 1875.	Pattern 1884.	Pattern 1881.*	Pattern 1881.						Pattern 1875, and 1875 jacketed.						Pattern 1870, and 1870 jacketed.					Pattern 1870, and 1870 jacketed.				
Desig. by Calibre, in cms.	42	37	34 short.	16 heavy.	16 light.	14	10	9	6·5	34	27 jack'd.	27 I.	27 II.	10 jack'd.	10	32 jack'd.	32	27 jack'd.	27	24 jack'd.	19 jack'd.	16	14 jack'd.	9·0	6·5
Calibre, in inches	16·54	14·66	13·39	6·49	6·49	5.46	3·94	3·54	2·56	13·4	10·8	10·8	10·8	3·94	3·94	12·6	12·6	10·8	10·8	9·45	7·64	6·49	5·46	3·54	2·57
Total length, in feet.	32·5	..	..	15·97	15·97	14·34	9·26	7·11	3·94	22·0	19·3	19·3	19·3	9·26	9·26	22·0	22·0	17·7	17·7	16·2	13·6	12·2	10·3	7·12	3·58
Length of Bore, in inches.	366·0	..	..	180·9	180·9	162·6	102·6	77·9	41·18	241·5	213·4	213·4	213·6	104·3	104·3	243·6	243·6	194·3	194·3	179·1	151·0	187·3	115·0	78·0	38·4
Length of Bore, in calibres	22·1	..	..	27·9	27·9	30	26	22	16	18·0	19·8	19·8	19·8	26·5	26·5	19·5	19·5	18·0	18·0	19·0	19·8	21·2	21·1	22·0	15·0
Number of Grooves.	84	..	..	50	50	42	30	28	20	68	54	54	42	20	20	64	64	54	54	48	38	50	28	36	26
Depth of Grooves.	0·079	..	0·059	0·039	0·039	0·035	0·028	0·024	0·020	0·059	0·059	0·059	0·059	0·032	0·032	0·059	0·059	0·059	0·059	0·059	0·059	0·039	0·047	0·031	0·031
Rifling Twist.	7°	..	..	7°	7°	7°	7°	7°	8°	4°	4°	4°	4°	7°	7°	4°	4°	4°	4°	4°	4°	7°	4°	7°	8°
Total weight, in tons	74·6	71	51·8	5·0	3·9	3·1	1·18	0·59	0·09	47·58	27·85	27·36	24·11	1·24	1·18	38·38	38·38	22·83	22·84	15·41	7·83	4·98	2·63	0·59	0·094
Weight of Firing Charge: Armour piercing projectile, lbs.	..	546	357·1	..	..	..	..	..	..	257·9	165·3	136·7	103·6	..	..	189·6	152·1	136·7	92·6	101·4	60·4	39·7	..	—	—
Weight of Firing Charge: Common Shell „	..	..	..	..	..	..	..	..	..	231·5	145·5	121·3	103·6	10·1	7·1	172·0	152·1	126·8	92·6	92·6	..	39·7	13·6	3·62	0·90
Weight: Armour Piercing Projectile, lbs.	1984·2	1180	925·9	..	..	..	..	..	..	925·9	476·2	476·2	476·2	..	..	760·6	760·6	476·2	476·2	317·5	165·3	99·2	..	—	—
Weight: Common Shell „	..	..	..	..	..	..	..	..	..	771·6	396·8	396·8	396·8	30·9	26·5	631·6	631·6	396·8	396·8	264·6	137·8	99·2	61·7	17·6	5·95
Weight: Case Shot „	..	..	..	..	..	..	..	..	..	..	321·9	321·9	321·9	18·7	18·7	..	..	321·9	321·9	220·5	105·8	68·3	42·8	17·0	6·39
Muzzle Velocity, in feet, sec.	1739	1955	..	..	..	..	..	..	..	1595	1736	1641	1542	1673	1591	1542	1437	1575	1424	1624	1739	1782	1529	1493	1135
Muzzle Energy: Total, in foot-tons	41590	31272	24868	..	..	..	..	..	..	16320	9942	8865	7834	..	..	12540	10880	8191	6680	5794	3465	2183	..	—	—
Muzzle Energy: Per in. circ., ft. tons	800	684	591	..	..	..	..	..	..	388	293	261	331	..	..	317	275	241	197	195	144	107	..	—	—
Perforation at Muzzle, ins.	29·4	27·4	25·5	..	..	..	..	..	..	20·3	17·8	16·7	15·6	..	..	18·3	16·9	16·0	14·3	14·4	12·5	10·8	..	—	—

* Details of other guns of the pattern 1881, have been communicated confidentially to the British Government, viz. 27-cm., 24-cm.

GERMAN NAVAL ORDNANCE.

		Krupp Steel Breech-loading Guns, designated by calibre.																							Bronze B.L.
Designation in centimètres		30·5 jack'd.	26 long.	26 jack'd.	26 short.	24 long.	24 short.	21 long.	21 long.	21 short.	21 short.	17 long.	17 short.	15 long.	15 short jack'd.	15 short.	15 short.	15 short jack'd.	15 short jack'd.	12·5 hoop'd.	12 hoop'd.	10·5 long.	8·7	8	8	8
Calibre, in inches		12·01	10·33	10·33	10·33	9·45	9·37	8·21	8·24	8·24	8·24	6·80	6·80	5·87	5·87	5·87	5·87	5·87	5·87	4·92	4·74	3·06	3·43	3·09	3·09	3·19
Length	Total, in feet	21·98	18·77	18·77	17·06	23·63	15·45	24·0	20·61	15·45	12·88	13·94	11·32	14·67	10·73	10·73	10·73	10·68	10·68	9·60	9·6	12·08	6·89	6·89	6·89	5·15
	Rifled portion, in ins.	181·9	149·8	150·0	129·3	201·6	116·2	218·2	176·5	124·6	114·9	117·1	102·2	128·5	93·3	87·1	86·7	87·1	86·7	85·7	85·3	113·6	62·7	57·6	57·6	45·9
	Powder Chamber "	45·3	44·7	44·4	44·7	53·5	40·9	75·3	46·7	37·1	34·0	31·5	16·7	31·1	19·0	25·1	25·5	25·1	25·5	16·7	16·7	19·5	10·7	10·5	10·5	9·73
	Bore, in calibres	18·9	18·8	18·8	16·8	26·1	16·8	35·6	27·1	19·6	18·1	21·9	17·5	27·2	19·1	19·1	19·1	19·1	19·1	20·8	21·6	33·6	21·4	22·0	22·0	17·4
Number of Grooves		72	36	48	36	56	48	48	48	30	30	30	30	36	36	36	24	36	24	32	18	32	24	12	12	12
Depth of Grooves, in inches		0·079	0·077	0·079	0·077	0·059	0·061	0·059	0·059	0·102	0·102	0·063	0·063	0·059	0·061	0·061	0·061	0·061	0·061	0·059	0·051	0·049	0·049	0·049	0·049	0·051
Twist, in calibres		45	50	50	50	25	45	25	25	68	59	45	45	25	45	45	68	50	65	40	60	25	40	46	46	46
Weight	Gun, including Breech Gear, tons	35·4	21·7	18·7	17·7	18·7	14·6	13·03	12·3	9·84	8·86	5·51	3·40	4·04	3·44	3·44	3·44	3·15	3·15	1·38	1·35	1·15	0·44	0·32	0·29	0·23
	Breech Block, in lbs.	2954	2050	1973	1973	..	1378	831·1	908·3	831·1	831·1	496·0	414·5	390·2	324·1	324·1	324·1	324·1	381·4	163·1	163·1	149·9	86·0	63·9	63·9	55·1
	Armour-piercing projectile, in lbs.	725·3	412·3	412·3	412·3	474·0	306·4	308·6	308·6	217·2	217·2	117·9	117·9	112·4	76·1	76·1	76·1	76·1	78·8	—	—	—	—	—	—	—
	Common Shells, in lbs.	725·3	357·1	357·1	357·1	474·0	261·5	303·6	308·6	174·2	174·2	112·9	112·9	112·4	65·0	65·0	65·0	65·0	61·1	40·1	38·1	39·7	14·9	9·4	9·4	8·3
Weight of Bursting Charge	Armour-piercing Shells, in lbs.	7·7	5·3	5·3	5·3	6·6	3·2	5·5	5·5	2·8	2·8	1·3	1·3	1·5	0·8	0·8	0·8	0·8	—	—	—	—	—	—	—	—
	Common Shells, in lbs.	19·8	14·3	14·3	22·0	15·4	15·4	12·1	12·1	6·6	6·6	5·1	5·1	4·3	4·2	4·2	4·2	4·2	..	2·4	2·5	0·9	0·4	0·4	0·6	0·6
Weight of Firing Charge	Armour-piercing Shells, in lbs.	202·8	105·8	105·8	125·7	152·1	67·2	103·6	103·6	41·9	35·3	30·9	16·5	38·1	14·3	17·1	18·2	17·1	13·2	—	—	—	—	—	—	—
	Common Shells, in lbs.	202·8	105·8	105·8	125·7	152.1	50·7	103·6	103·6	41·9	35·3	30·9	16·5	38·1	14·3	17·1	12·1	17·1	12·1	8·8	4·6	8·8	3·3	1·1	1·1	0·9
Initial Velocity	Armour-piercing projectile, feet-seconds.	1718	1588	1588	1578	1657	1493	1739	1657	1463	1316	1608	1326	1624	1463	1463	1358	1463	1358	—	—	—	—	—	—	—
	Common shell, ft.-sec.	1718	1641	1641	1654	1657	1391	1739	1657	1394	1276	1654	1342	1624	1555	1555	1447	1555	1447	1545	1280	1526	1545	1148	1119	1053
Muzzle Energy	Total, foot-tons	14,740	7211	7211	7119	9024	4736	6471	5876	8225	2606	2112	1436	2055	1131	1131	974	1181	1002	—	—	—	—	—	—	—
	Per inch circ., foot-tons	391	223	223	220	304	161	250·0	227	125	101	98·9	67·3	111·5	61·3	61·3	52·8	61·3	54·3	—	—	—	—	—	—	—
Perforation at Muzzle, in inches		30·5	15·4	15·4	15·3	18·1	13·0	16·4	15·6	11·4	10·1	10·3	8·3	11·0	8·0	8·0	7·4	8·0	7·5	—	—	—	—	—	—	—

NOTE.—See two 40-cm. Krupp L.S. guns, given on Col. Maitland's Table, p. 837, Annual 1886, viz. 71 tons and 119 tons weight.

ITALIAN NAVAL ORDNANCE.

		Armstrong Breech Loading.				B.L.	Armstrong Muzzle Loading.							Muzzle Loading. Old Pattern.		Breech Loading.	
Designation by Calibre, in centimètres		43 New Pattern.	43* Early Pattern. 1882.	15	12	12	45	28 New Pattern.	25 No. 1 Long.	25 No. 2 Short.	25 No. 2.	22	20	16	16	7·5 No. 1.	7·5 No. 2.
Calibre, in inches		17	17	59·1	4·72	4·7	17·72	11	10	10	10	9	8	7	7	3	3
Length	Total, in feet	40·75	39	13·8	8·5	9·25	32·7	14·4	14·4	14	13·8	13·8	10·8	11·8	10·6	5·8	3·3
	Rifled Bore, in inches	346·8	315·7	126	75	88	302	121	120	114	112	106	89	96	87	52	27
	Powder Chamber, in inches	84·5	98	28	10·8	22	56·5	24·5	26·0	26·0	14·0	19·5	15·7	21·3	21·3	10·2	7·9
	Bore, in Calibres	27	26	26	20·2	23·5	20·5	13·2	14·6	14·0	12·6	13·9	13·1	16·8	15·5	20·7	11·7
No. of Grooves		82	82	28	37	36	28	9	7	7	8	6	6	6	6	12	12
Twist of Rifling, in Calibres		50	50	40	40	42	50	35	40	40	55	45	45	42·5	27·3	48	48
Total Weight, in Tons		104·3	101·5	4	1·20	1·38	100	25·0	18·0	18·0	12·1	12·6	7·02	5·12	3·54	0·29	0·095
Firing Charge	Armour-piercing projectile, in lbs.	900·0	725	34	..	..	551	94·8	77·2		63·9	50·0	35·0	19·8	—	—	—
	Common shell "	600	480	25	5·5	9·3	440·9	66·1	52·9		41·9	33·0	21·0	7·1	7·1	1·9	0·7
Weight.	Armour-piercing projectile, in lbs.	2000	2000	80	..	..	2000	560·0	451·9		331·8	250·0	180·0	101·4	—	—	—
	Common Shell, in lbs.	2000	2000	80	31·7	36·4	2000	533·5	399·0		284·4	250·0	180·0	66·1		91·7	93·0
	Shrapnel, in lbs.	2000	2000	80	31·7	37·37	2000	533·5	399·0		284·4	250·0	180·0	66·1		91·7	93·0
	Case Shot "	2000	2000	70	23·5	35·9	2000	200·1	188·1		135·6	99·6	79·4	33·1		64·6	64·6
Bursting Charge	Armour-piercing projectile, in lbs.	32	32	1·5	..	..	32	15·0	11·1		8·4	6·3	3·6	—		—	—
	Common Shell, in lbs.	60	60	5	3·1	2·2	78	26·0	23·8		18·2	18·8	9·7	2·8		0·3	0·4
	Shrapnel "	5	5	0·16	0·28	0·35	5	2·2	1·85		1·96	1·48	0·71	0·50		0·02	0·02
Muzzle Velocity, in feet		1992	1935	1946	1394	1591	1700	1329	1388		1373	1412	1353	1303	1024	1335	—
Muzzle Energy	Total, foot-tons	55,030	51,930	2100	..	..	40,060	6859	6035		4369	36,040	22,850	1195	—	—	—
	Per inch circumference, foot-tons	1035	976·3	114.1	..	..	753·4	198·6	192·2		139·1	128·6	99·8	54·4	—	—	—
Perforation at Muzzle, inches		33·7	32·8	11·2	..	..	28·5	14·2	14·1		12·0	11·5	10·1	7·5	—	—	—

* At Spezia Grüson shield trial (see p. 321, Annual 1886) the projectile weighed 2204·6 lbs. (100 kg.). The charge was 826·7 lbs. Cologne prismatic powder. The muzzle velocity was about 1775 feet, and muzzle energy 48,184.

RUSSIAN NAVAL ORDNANCE.

		Obuchoff Steel Breech Loading Hooped Guns.											Steel B.L. Guns.		
Designation by Calibre, in inches		12 Long.	12	11	11 Pattern 77.	9	9	8	6 Long.	6·03	6	Long 9-pdr.	4·2 (9-pdr.)	3·43 Long (4-pdr.)	3·43 (4-pdr.)
Calibre in centimètres		30·48	30·48	27·94	27·94	22·86	22·86	20·32	15·24	15·32	15·24	10·67	10·67	8·70	8·70
Total Length, in feet		30	20	18·3	20·0	15·0	13	14·6	14	12·2	11·7	6·9	7·0	6·9	5·8
Length of Rifled Portion of Bore, in inches		..	165·0	152·0	158·0	124·0	..	128·0	118·7	106 0	98·0	61·5	65·0	62·6	53·0
Length of Powder Chamber „		..	38·5	35·0	50·4	28·5	..	23·0	30·5	22·4	22·2	10·5	8·0	10·7	—
Length of Bore in calibres, including Powder Chamber		..	17	17	18·9	16·9	..	18·9	24·9	21·3	20	17·1	17·4	21·4	—
Number of Grooves, in inches		..	36	36	64	32	32	30	..	24	24	24	16	24	12
Depth of Grooves „		0·070	0·135	0·135	0·135	0·110	0·110	0·090	0·060	0·085	0·070	0·055	0·055	0·050	0·050
Twist of Rifling in calibres		..	73·5	70	..	60	60	70	*24	60	68	*40	50	40	41
Total Weight, in tons		50·45	39·9	28·2	28·2	15·0	12·5	9·67	4·07	4·35	4·03	0·60	0·87	0·45	0·35
Weight of	Steel Shell, in lbs.	..	665·8	515·9	..	249·1	275·6	172·0	..	97·6	86·0	—	—	—	—
	Chilled Shell, „	731·9	665·8	515·9	562·2	275·6	264·7	169·8	119·0	86·0	86·0	—	—	—	—
	Common Shell, „	..	639·3	496·0	520·3	266·8	266·8	172·0	..	81·6	81·6	27·6	24·2	15·2	12·6
	Case Shot, „	..	293·2	216·1	..	176·4	176 4	134·5	..	57·3	57·3	27·6	22·3	15·2	11·0
Weight of Firing Charge.	Steel Shell, „	..	144 4	115·3	..	64·2	47 0	31·5	..	14·3	18·1	—	—	—	—
	Chilled Shell, „	216·9	144·6	90·6	132 2	47·0	47·0	29·3	37·5	14·3	18·1	—	—	—	—
	Common Shell, „	..	117·3	81·6	132·2	42·1	42·1	28·4	..	10·8	14·3	4·5	2·6	3·1	1·3
Muzzle Velocity, in feet		1942	1470	1486	1516	1463	1260	1352	..	1206	1463	—	—	—	—
Muzzle Energy	Total, foot-tons	19140	9965	7905	8999	3701	3035	2180	..	982	1276	—	—	—	—
	Per Inch Circumference, foot-tons	508·4	264·5	229·4	260·4	030·9	107·4	86·7	..	51·8	67·74	—	—	—	—
Perforation † at Muzzle, in inches		23·6	16·7	15·5	16·6	11·7	10·5	9·5	..	7·2	8·4	—	—	—	—

* Maximum of increasing twist. † Through iron unbacked.

SPANISH NAVAL ORDNANCE.

		Hontoria, New Pattern.					Hontoria, Pattern 83.						Armstrong, Pattern 83.						Armstrong.			Krupp.				
		Breech Loading.					Breech Loading.												Muzzle Loading.		Pattrn. 81 B.L.	Breech Loading.				
Designation by Calibre		16-cm. No. 1.	16-cm	12-cm.	9-cm.	7-cm.	32-cm.	28-cm.	24-cm.	20-cm.	16-cm.	12-cm.	24-cm.	20·3-cm	15-cm.	12-cm.	8·4-cm	7·5-cm long.	22·86-cm	20·3-cm	6-in.	15-cm.	12-cm.	8·7-cm	7·5-cm	7·5-cm short.
Calibre, in inches		6·34	6·34	4·72	3·54	2·76	12·60	11·02	9·45	7·87	6·34	4·72	9·449	8·00	6·00	4·72	3·3	2·95	9·00	8·00	6·00	5·87	4·72	3·43	2·95	2·95
Length	Total length, in feet	13·8	9·63	10·4	7·8	3·7	38·7	33·8	..	..	19·3	14·5	29	18·4	17·00	13·75	7·9	7·51	13·0	11·9	14·5	17·13	11·81	6·9	6·3	3·22
	Rifled Portion, in inches	125·6	89·8	94·5	70·9	35·4	352·4	309·1	..	..	170·9	135·8	260·2	162·0	158·3	135·8	75·0	70·7	104·0	102·0	126·9	..	..	..	57·6	—
	Powder Chamber, in inches	31·9	17·3	23·8	17·7	6·1	..	..	..	..	..	..	66·9	43·5	31·4	19	13	13	..	..	29·7	—	—	—	—	—
	Bore, in calibres.	25	16·9	25	25	15	36*	36*	..	..	36*	37*	35	26	32	33	27	28·7	14	14·75	26·1	35*	30*	24*	25·8*	13*
No. of Grooves		38	38	30	22	18	80	70	60	50	40	30	60	33	28	22	20	18	6	4	28	36	32	24	24	24
Depth of Grooves, in inches.		0·59	0·59	0·49	0·49	0·49	0·59	0·59	0·59	0·59	0·59	0·49	0·49	0·025	0·037	0·03	0·03	0·03	0·18	0·18	..	0·59	0·59	0·49	0·49	0·49
Twist of Rifling, in calibres.		Increasing from 100 to 49.	56	Increasing from 100 to 40.			From 0 to 30.						30	45	30	40	30	35	45	40	100 to 40	25	25	40	36	25
Total Weight, in tons		5·6	2·71	1·4	0·59	0·10	48·2	32·5	19·8	11·5	6·1	2·6	21	11·5	5·0	2·2	0·45	0·35	12·5	9·0	4·0	4·6	2·1	0·49	0·30	0·09
Weight	Armour-piercing projectile, in lbs.	93·7	..	..	..	..	1058	727·5	440·9	253·5	132·3	55·1	445	180	100·0	40·0	..	..	2500	180·0	78·0	85·10	43·65	—	—	—
	Common Shell, in lbs.	83·8	63·9	36·2	15·4	7·28	..	..	..	..	116·8	49·6	393	180	100·0	40·0	15·0	12·0	2500	180 0	83·6	65·70	34·61	14·6	9·48	9·48
	Ring Segment, in lbs.	83·8	..	33·1	17·0	7·9	..	..	..	..	116·8	49·6	..	..	..	40·0	15·0	12·0	..	..	..	..	34·61	14·6	9.04	9·04
Firing Charge	Armour-piercing projectile, in lbs.	26·5	..	..	..	..	..	..	..	..	..	..	220	90	55·0	16·0	..	..	50·0	35·0	34·0	37·48	19·29	—	—	—
	Other projectiles	24·3	15·4	13·2	6·28	0·99	..	..	..	..	..	..	145	65	34·0	12·0	4·0	3·75	33·0	21·0	39·0	..	..	10·3	10·4	—
Muzzle Velocity, in feet		1631	1493	1749	1837	1037	..	..	..	..	..	..	1950	2020	2070	2000	1625	1709	..	..	1936	2182	2034	1539	1542	961
Muzzle Energy	Total, in foot-tons	1729	988	702	..	..	..	..	..	..	..	..	11730	5094	2972	1109	275	243	..	..	2173	2809	1252	—	—	—
	Per inch circumference, foot-tons	87·4	..	..	..	..	..	..	..	..	..	..	397·4	203·8	156·4	75·15	..	..	..	..	..	152·4	84·45	—	—	—
Perforation at Muzzle, in inches		9·6	..	..	..	..	..	..	..	..	..	..	20·9	15·0	13·22	9·09	..	..	..	..	..	12·9	9·63	—	—	—

18 and 16-cm. Palliser guns and 16 and 13-cm. Parrot guns also exist.

* Total length, the length of bore not being supplied.

NAVAL ORDNANCE OF SWEDEN AND NORWAY.

		Sweden.				Norway.								
		Breech Loaders.			M.L.	Krupp, Hooped B.L.		Armstrong, M.L.				Palliser, M.L.		Cast-iron, M.L.
Designation by Calibre		27-cm.	24-cm.	17-cm.	12-cm.	26-cm.	15-cm.	8½-in.	8½-in.	8½-in.	6½-in.	5½-in.	5-in.	5-in.
Calibre, inches		10·80	9·45	6·58	4·80	10·24	5·91	10·51	10·51	10·51	7·88	6·58	6·11	6·11
Total Length, feet		17·46	14·96	11·27	8·87	18·77	12·63	16·87	14·66	13·49	10·82	11·58	10·30	11·21
Length	Rifled Portion of Bore in inches	161·8	138·0	108·6	83·3	160·4	112·4	137·3	121·0	110·6	85·7	92·4	91·7	101·6
	Chamber, „	30·0	26·7	16·8	13·6	34·1	22·6	38·2	24·0	20·5	18·5	19·3	10·8	14·5
	Bore in calibres, „	17·8	17·4	19·1	20·2	19·0	22·8	16·7	13·8	12·5	13·2	17·0	16·8	19·0
Number of Grooves		5	5	5	8	60	36	8	8	8	6	3	3	3
Twist of Rifling		..	30	..	40	45	45	55	55	55	50	34	34	34
Total Weight, tons		23·9	14·4	5·2	1·9	21·7	3·9	21·4	19·5	18·1	7·5	4·8	3·4	2·9
Weight of	Chilled Shell, lbs.	476·2	317·5	108·0	..	463·0	86·0	447·5	385·8	385·8	153·2	110·2	—	—
	Common Shell, „	396·8	224·9	76·3	34·6	381·4	69·4	308·6	308·6	308·6	148·8	82·7	59·1	59·1
Weight of Firing Charge	Chilled Shell, lbs.	98·1	59·5	23·4	..	99·2	18·7	121·3	71·7	66·1	29·7	22·0	—	—
	Common Shell, „	66·1	37·5	17·6	6·6	81·6	18·7	77·2	38·6	33·6	19·8	11·0	7·17	7·17
Muzzle Velocity, feet		1365	1322	1378	..	1575	1575	1555	1378	1296	1296	1329	—	—
Total foot-tons		6152	3848	1422	..	7966	1479	7502	5082	4495	1785	1350	—	—
Muzzle Energy	Per inch Circumference	179·6	129·6	68·8	..	247·7	79·7	227·3	153·9	136·1	72·1	65·3	—	—
	Perforation through Iron	13·65	11·5	8·4	..	16·2	9·2	15·6	12·6	11·8	8·6	8·2	—	—

UNITED STATES—NAVAL ORDNANCE.

Supplied by Lieut. Jacques, U.S. Navy.

Forged Steel, built up B.-L. Guns.

NAME OF GUN.		Length of Gun.							Weight of Projectiles.		Charge.				
	Calibre.	Total Length.	Length of Bore.		Rifled Portion.	Powder Chamber.	Twist of Rifling.	Total Weight.	Armour Piercing.	Common.	Firing.	Bursting.	Initial Velocity.	Muzzle Energy.	Perforation of Wrought Iron at Muzzle.
	inch.	inch.	inch.	Cal.	inch.	inch.		tons.	lbs.	lbs.	lbs.	lbs. or oz.	ft. per sec.	ft.-tons.	inch.
Finished.															
5-in. B.L.R.	5	162·0	152	30·6	120·75	29·2	1 turn in 30 cals.*	2·77	60	60	30	3	1960	1,599	10·6
6-in. B.L.R.	6	196	185·75	31·12	144·26	40·49		4·58	100	100	50	6	2105	3,072	13·4
8-in. B.L.R.	8	257·99	242·46	30·43	194·16	49·61		12·53	250	250	125	13	2050	7,286	17·8
10-in. B.L.R.	10	329·10	310·22	31·02	246·26	60·96		26	500	500	250	22	2100	15,290	23·1
Under Construction.															
8-in. B.L.R.	8	264·5	248·97	31·25	195·80	53·21		11·48	250	250	125	13	2100	7,643	18·3
10-in. B.L.R.	10	329·1	310·22	31·02	246 26	60·96		26·0	500	500	250	22	2100	15,290	23·1
10½-in. B.L.R.	10½	368·6	350·0	33·3	281·8	69·0		29·0	550	550	275	24	2100	16,813	23·7
Forgings contracted for.†															
12-in. B.L.R.	12	422·6	400·12	33·42	319·81	79·31		47·0	850	850	425	38	2100	25,984	27·6

* Rifling polygroove, increasing twist. In the 8-inch Rifle, from 1 in 180 to 1 in 30 calibres at 13 inches from muzzle, then uniform.

† The 12-inch, as well as 6, 8, and 10-inch guns are to be finished in the Naval Ordnance Factory, Washington; 16-inch guns of 109 tons and 150 tons are designed.

NAVAL ORDNANCE OF SWEDEN AND NORWAY.

		Sweden.				Norway.							
		Breech Loaders.			M.L.	Krupp, Hooped B.L.		Armstrong, M.L.				Palliser, M.L.		Cast-iron, M.L.
Designation by Calibre		27-cm.	24-cm.	17-cm.	12-cm.	26-cm.	15-cm.	8½-in.	8½-in.	8½-in.	6½-in.	5½-in.	5-in.	5-in.
Calibre, inches		10·80	9·45	6·58	4·80	10·24	5·91	10·51	10·51	10·51	7·88	6·58	6·11	6·11
Total Length, feet		17·46	14·96	11·27	8·87	18·77	12·63	16·87	14·66	13·49	10·82	11·58	10·30	11·21
Length	Rifled Portion of Bore in inches	161·8	138·0	108·6	83·3	160·4	112·4	137·3	121·0	110·6	85·7	92·4	91·7	101·6
	Chamber, "	30·0	26·7	16·8	13·6	34·1	22·6	38·2	24·0	20·5	18·5	19·3	10·8	14·5
	Bore in calibres, "	17·8	17·4	19·1	20·2	19·0	22·8	16·7	13·8	12·5	13·2	17·0	16·8	19·0
Number of Grooves		5	5	5	8	60	36	8	8	8	6	3	3	3
Twist of Rifling		..	30	..	40	45	45	55	55	55	50	34	34	34
Total Weight, tons		23·9	14·4	5·2	1·9	21·7	3·9	21·4	19·5	18·1	7·5	4·8	3·4	2·9
Weight of	Chilled Shell, lbs.	476·2	317·5	108·0	..	463·0	86·0	447·5	385·8	385·8	153·2	110·2	—	—
	Common Shell, "	396·8	224·9	76·3	34·6	381·4	69·4	308·6	308·6	308·6	148·8	82·7	59·1	59·1
Weight of Firing Charge	Chilled Shell, lbs.	98·1	59·5	23·4	..	99·2	18·7	121·3	71·7	66·1	29·7	22·0	—	—
	Common Shell, "	66·1	37·5	17·6	6·6	81·6	18·7	77·2	38·6	33·6	19·8	11·0	7·17	7·17
Muzzle Velocity, feet		1365	1322	1378	..	1575	1575	1555	1378	1296	1296	1329	—	—
Total foot-tons		6152	3848	1422	..	7966	1479	7502	5082	4495	1785	1350	—	—
Muzzle Energy	Per inch Circumference	179·6	129·6	68·8	..	247·7	79·7	227·3	153·9	136·1	72·1	65·3	—	—
	Perforation through Iron	13·65	11·5	8·4	..	16·2	9·2	15·6	12·6	11·8	8·6	8·2	—	—

UNITED STATES—NAVAL ORDNANCE.

Supplied by Lieut. Jacques, U.S. Navy.

Forged Steel, built up B.-L. Guns.

NAME OF GUN.		Length of Gun.							Weight of Projectiles.		Charge.				
	Calibre.	Total Length.	Length of Bore.		Rifled Portion.	Powder Chamber.	Twist of Rifling.	Total Weight.	Armour Piercing.	Common.	Firing.	Bursting.	Initial Velocity.	Muzzle Energy.	Perforation of Wrought Iron at Muzzle.
	inch.	inch.	inch.	Cal.	inch.	inch.		tons.	lbs.	lbs.	lbs.	lbs. or oz.	ft. per sec.	ft.-tons.	inch.
Finished.															
5-in. B.L.R.	5	162·0	152	30·6	120·75	29·2	1 turn in 30 cals.*	2·77	60	60	30	3	1960	1,599	10·6
6-in. B.L.R.	6	196	185·75	31·12	144·26	40·49		4·58	100	100	50	6	2105	3,072	13·4
8-in. B.L.R.	8	257·99	242·46	30·43	194·16	49·61		12·53	250	250	125	13	2050	7,286	17·8
10-in. B.L.R.	10	329·10	310·22	31·02	246·26	60·96		26	500	500	250	22	2100	15,290	23·1
Under Construction.															
8-in. B.L.R.	8	264·5	248·97	31·25	195·80	53·21		11·48	250	250	125	13	2100	7,643	18·3
10-in. B.L.R.	10	329·1	310·22	31·02	246 26	60·96		26·0	500	500	250	22	2100	15,290	23·1
10½-in. B.L.R.	10½	368·6	350·0	33·3	281·8	69·0		29·0	550	550	275	24	2100	16,813	23·7
Forgings contracted for.†															
12-in. B.L.R.	12	422·6	400·12	33·42	319·81	79·31		47·0	850	850	425	38	2100	25,984	27·6

* Rifling polygroove, increasing twist. In the 8-inch Rifle, from 1 in 180 to 1 in 30 calibres at 13 inches from muzzle, then uniform.

† The 12-inch, as well as 6, 8, and 10-inch guns are to be finished in the Naval Ordnance Factory, Washington; 16-inch guns of 109 tons and 150 tons are designed.

NAVAL ORDNANCE OF SWEDEN AND NORWAY.

		Sweden.				Norway.								
		Breech Loaders.			M.L.	Krupp, Hooped B.L.		Armstrong, M.L.				Palliser, M.L.		Cast-iron, M.L.
Designation by Calibre		27-cm.	24-cm.	17-cm.	12-cm.	26-cm.	15-cm.	8½-in.	8½-in.	8½-in.	6½-in.	5½-in.	5-in.	5-in.
Calibre, inches		10·80	9·45	6·58	4·80	10·24	5·91	10·51	10·51	10·51	7·88	6·58	6·11	6·11
Total Length, feet		17·46	14·96	11·27	8·87	18·77	12·63	16·87	14·66	13·49	10·82	11·58	10·30	11·21
Length	Rifled Portion of Bore in inches	161·8	138·0	108·6	83·3	160·4	112·4	137·3	121·0	110·6	85·7	92·4	91·7	101·6
	Chamber, „	30·0	26·7	16·8	13·6	34·1	22·6	38·2	24·0	20·5	18·5	19·3	10·8	14·5
	Bore in calibres, „	17·8	17·4	19·1	20·2	19·0	22·8	16·7	13·8	12·5	13·2	17·0	16·8	19·0
Number of Grooves		5	5	5	8	60	36	8	8	8	6	3	3	3
Twist of Rifling		..	30	..	40	45	45	55	55	55	50	34	34	34
Total Weight, tons		23·9	14·4	5·2	1·9	21·7	3·9	21·4	19·5	18·1	7·5	4·8	3·4	2·9
Weight of	Chilled Shell, lbs.	476·2	317·5	108·0	..	463·0	86·0	447·5	385·8	385·8	153·2	110·2	—	—
	Common Shell, „	396·8	224·9	76·3	34·6	381·4	69·4	308·6	308·6	308·6	148·8	82·7	59·1	59·1
Weight of Firing Charge	Chilled Shell, lbs.	98·1	59·5	23·4	..	99·2	18·7	121·3	71·7	66·1	29·7	22·0	—	—
	Common Shell, „	66·1	37·5	17·6	6·6	81·6	18·7	77·2	38·6	38·6	19·8	11·0	7·17	7·17
Muzzle Velocity, feet		1365	1322	1378	..	1575	1575	1555	1378	1296	1296	1329	—	—
Total foot-tons		6152	3848	1422	..	7966	1479	7502	5082	4495	1785	1350	—	—
Muzzle Energy	Per inch Circumference	179·6	120·6	68·8	..	247·7	79·7	227·3	153·9	186·1	72·1	65·3	—	—
	Perforation through Iron	13·65	11·5	8·4	..	16·2	9·2	15·6	12·6	11·8	8·6	8·2	—	—

UNITED STATES—NAVAL ORDNANCE.

Supplied by Lieut. Jacques, U.S. Navy.

Forged Steel, built up B.-L. Guns.

NAME OF GUN.		Length of Gun.							Weight of Projectiles.		Charge.				
	Calibre.	Total Length.	Length of Bore.		Rifled Portion.	Powder Chamber.	Twist of Rifling.	Total Weight.	Armour Piercing.	Common.	Firing.	Bursting.	Initial Velocity.	Muzzle Energy.	Perforation of Wrought Iron at Muzzle.
	inch.	inch.	inch.	Cal.	inch.	inch.		tons.	lbs.	lbs.	lbs.	lbs. or oz.	ft. per sec.	ft.-tons.	inch.
Finished.															
5-in. B.L.R.	5	162·0	152	30·6	120·75	29·2	1 turn in 30 cals.*	2·77	60	60	30	3	1960	1,599	10·6
6-in. B.L.R.	6	196	185·75	31·12	144·26	40·49		4·58	100	100	50	6	2105	3,072	13·4
8-in. B.L.R.	8	257·99	242·46	30·43	194·16	49·61		12·53	250	250	125	13	2050	7,286	17·8
10-in. B.L.R.	10	329·10	310·22	31·02	246·26	60·96		26	500	500	250	22	2100	15,290	23·1
Under Construction.															
8-in. B.L.R.	8	264·5	248·97	31·25	195·80	53·21		11·48	250	250	125	13	2100	7,643	18·3
10-in. B.L.R.	10	329·1	310·22	31·02	246 26	60·96		26·0	500	500	250	22	2100	15,290	23·1
10½-in. B L.R.	10½	368·6	350·0	33·3	281·8	69·0		29·0	550	550	275	24	2100	16,813	23·7
Forgings contracted for.†															
12-in. B.L.R.	12	422·6	400·12	33·42	319·81	79·31		47·0	850	850	425	38	2100	25,984	27·6

* Rifling polygroove, increasing twist. In the 8-inch Rifle, from 1 in 180 to 1 in 30 calibres at 13 inches from muzzle, then uniform.

† The 12-inch, as well as 6, 8, and 10-inch guns are to be finished in the Naval Ordnance Factory, Washington; 16-inch guns of 109 tons and 150 tons are designed.

NAVAL ORDNANCE OF SWEDEN AND NORWAY.

		Sweden.				Norway.							
		Breech Loaders.			M.L.	Krupp, Hooped B.L.		Armstrong, M.L.				Palliser, M.L.		Cast-iron, M.L.
Designation by Calibre		27-cm.	24-cm.	17-cm.	12-cm.	26-cm.	15-cm.	8½-in.	8½-in.	8½-in.	6½-in.	5½-in.	5-in.	5-in.
Calibre, inches		10·80	9·45	6·58	4·80	10·24	5·91	10·51	10·51	10·51	7·88	6·58	6·11	6·11
Total Length, feet		17·46	14·96	11·27	8·87	18·77	12·63	16·87	14·66	13·49	10·82	11·58	10·30	11·21
Length	Rifled Portion of Bore in inches	161·8	138·0	108·6	83·3	160·4	112·4	137·3	121·0	110·6	85·7	92·4	91·7	101·6
	Chamber, „	30·0	26·7	16·8	13·6	34·1	22·6	38·2	24·0	20·5	18·5	19·3	10·8	14·5
	Bore in calibres, „	17·8	17·4	19·1	20·2	19·0	22·8	16·7	13·8	12·5	13·2	17·0	16·8	19·0
Number of Grooves		5	5	5	8	60	36	8	8	8	6	3	3	3
Twist of Rifling		..	30	..	40	45	45	55	55	55	50	34	34	34
Total Weight, tons		23·9	14·4	5·2	1·9	21·7	3·9	21·4	19·5	18·1	7·5	4·8	3·4	2·9
Weight of	Chilled Shell, lbs.	476·2	317·5	108·0	..	463·0	86·0	447·5	385·8	385·8	153·2	110·2	—	—
	Common Shell, „	396·8	224·9	76·3	34·6	381·4	69·4	308·6	308·6	308·6	148·8	82·7	59·1	59·1
Weight of Firing Charge	Chilled Shell, lbs.	98·1	59·5	23·4	..	99·2	18·7	121·3	71·7	66·1	29·7	22·0	—	—
	Common Shell, „	66·1	37·5	17·6	6·6	81·6	18·7	77·2	38·6	38·6	19·8	11·0	7·17	7·17
Muzzle Velocity, feet		1365	1322	1378	..	1575	1575	1555	1378	1296	1296	1329	—	—
Total foot-tons		6152	3848	1422	..	7966	1479	7502	5082	4495	1785	1350	—	—
Muzzle Energy	Per inch Circumference	179·6	129·6	68·8	..	247·7	79·7	227·3	153·9	136·1	72·1	65·3	—	—
	Perforation through Iron	13·65	11·5	8·4	..	16·2	9·2	15·6	12·6	11·8	8·6	8·2	—	—

UNITED STATES—NAVAL ORDNANCE.

Supplied by Lieut. Jacques, U.S. Navy.

Forged Steel, built up B.-L. Guns.

NAME OF GUN.		Length of Gun.							Weight of Projectiles.		Charge.				
	Calibre.	Total Length.	Length of Bore.		Rifled Portion.	Powder Chamber.	Twist of Rifling.	Total Weight.	Armour Piercing.	Common.	Firing.	Bursting.	Initial Velocity.	Muzzle Energy.	Perforation of Wrought Iron at Muzzle.
	inch.	inch.	inch.	Cal.	inch.	inch.		tons.	lbs.	lbs.	lbs.	lbs. or oz.	ft. per sec.	ft.-tons.	inch.
Finished.															
5-in. B.L.R.	5	162·0	152	30·6	120·75	29·2	1 turn in 30 cals.*	2·77	60	60	30	3	1960	1,599	10·6
6-in. B.L.R.	6	196	185·75	31·12	144·26	40·49		4·58	100	100	50	6	2105	3,072	13·4
8-in. B.L.R.	8	257·99	242·46	30·43	194·16	49·61		12·53	250	250	125	13	2050	7,286	17·8
10-in. B.L.R.	10	329·10	310·22	31·02	246·26	60·96		26	500	500	250	22	2100	15,290	23·1
Under Construction.															
8-in. B.L.R.	8	264·5	248·97	31·25	195·80	53·21		11·48	250	250	125	13	2100	7,643	18·3
10-in. B.L.R.	10	329·1	310·22	31·02	246 26	60·96		26·0	500	500	250	22	2100	15,290	23·1
10½-in. B L.R.	10½	368·6	350·0	33·3	281·8	69·0		29·0	550	550	275	24	2100	16,813	23·7
Forgings contracted for.†															
12-in. B.L.R.	12	422·6	400·12	33·42	319·81	79·31		47·0	850	850	425	38	2100	25,984	27·6

* Rifling polygroove, increasing twist. In the 8-inch Rifle, from 1 in 180 to 1 in 30 calibres at 13 inches from muzzle, then uniform.

† The 12-inch, as well as 6, 8, and 10-inch guns are to be finished in the Naval Ordnance Factory, Washington; 16-inch guns of 109 tons and 150 tons are designed.

TABLE RELATING TO CONVERSION OF MEASURES.

Length.

METRIC TO ENGLISH. ENGLISH TO METRIC.

I. Mètres.	II. Yards.	III. Feet.	IV. Inches.	V. Yards.	VI. Mètres.	VII. Feet.	VIII. Mètres.	IX. Inches.	X. Centimètres.
1	1·0936	3·2809	39·37	1	0·91438	1	0·30479	1	2·5400
2	2·1873	6·5618	78·74	2	1·82877	2	0·60959	2	5·0799
3	3·2809	9·8427	118·11	3	2·74315	3	0·91438	3	7·6199
4	4·3745	13·1236	157·48	4	3·65753	4	1·21918	4	10·1598
5	5·4682	16·4045	196·85	5	4·57192	5	1·52397	5	12·6998
6	6·5618	19·6854	236·22	6	5·48630	6	1·82877	6	15·2397
7	7·6554	22·9663	275·60	7	6·40068	7	2·13356	7	17·7797
8	8·7491	26·2472	314·97	8	7·31507	8	2·43836	8	20·3196
9	9·8427	29·5281	354·34	9	8·22945	9	2·74315	9	22·8596

EXPLANATION.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point, and add together. Thus, find the number

of yards in 2354 mètres (see cols. I. & II.).	of feet in 12·4 mètres (see cols. I. & III.).	of inches in 30·5 centimètres (see cols. I. & IV.). Note, 1 m.=100 cm.	of mètres in 1026 yards (see cols. V. & VI.).	of mètres in 1742 feet (see cols. VII. & VIII.).	of centimètres in 17·72 ins. (see cols. IX. & X.)
mètres. yards.	mètres. feet.	cms. inches.	yards. mètres.	feet. mètres.	inches. cms.
2000=2187·3	10 =32·809	30·0=11·811	1000=914·38	1000=304·79	10·0 =25·400
300= 328·09	2 = 6·562	·5= ·197	20= 18·29	700=213·36	7·0 =17·780
50= 54·68	0·4= 1·312		6= 5·49	40= 12·19	0·7 = 1·778
4= 4·37				2= 0·61	·02= ·051
∴ 2354=2674·44	∴ 12·4=40·683	∴ 30·5=12·008	∴ 1026=938·16	∴ 1742=530·95	∴ 17·72=45·009

NOTE.—A ready way of approximately converting all French measures into English inches is to multiply by 4 and apply the decimal point by common sense—Thus for a 15-cm. gun; 15 × 4 = 60. Now this Calibre cannot be 60 inches, nor can it be 0·6 inches, therefore it must be 6 inches. (The exact value is 5·906 in.)

Weight.

METRIC TO ENGLISH. ENGLISH TO METRIC.

I. Kilogrammes.	II. Tons.	III. Pounds Avoirdupois.	IV. Grains Troy.	V. Tons.	VI. Milliers.	VII. Pounds Avoirdupois.	VIII. Kilogrammes.	IX. Grains. Troy.	X. Gramme.
1	·000984	2·2046	15432·3	1	1·016	1	0·4536	1	·0648
2	·001968	4·4092	30864·7	2	2·032	2	0·9072	2	·1296
3	·002953	6·6139	46297·0	3	3·048	3	1·3608	3	·1944
4	·003937	8·8185	61729·4	4	4·064	4	1·8144	4	·2592
5	·004921	11·0231	77161·7	5	5·080	5	2·2680	5	·3240
6	·005905	13·2277	92594·1	6	6·096	6	2·7216	6	·3888
7	·006889	15·4323	108026·4	7	7·112	7	3·1751	7	·4536
8	·007874	17·6370	123458·8	8	8·128	8	3·6287	8	·5184
9	·008858	19·8416	138891·1	9	9·144	9	4·0823	9	·5832

EXPLANATION.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point and add together. Thus, find the number

of tons in 35 milliers (see cols. I. & II. Note, 1000 kg. =1 millier).	of pounds in 56·3 kilogrammes. (see cols. I. & III.).	of grains in 120 grammes (see cols. I. & IV. Note, 1000 grms. = 1 kg.)	of milliers in 38 tons (see cols. V. & VI.).	of kilogrammes in 68 pounds (see cols. VII. & VIII).	of grammes in 85 grains (see cols. IX. & X.).
milliers. tons.	kgrms. lbs.	grammes. grains.	tons. milliers.	lbs. kgs.	grains. grammes.
30 = 29·53	50 =110·231	100=1543·23	30 = 30·48	60 = 27·216	80 = 5·184
5 = 4·92	6 = 13·228	20= 308·65	8 = 8·13	8 = 3·629	5 = 0·324
	0·3= .661				
∴ 35 = 34·45	∴ 56·3=124·120	∴ 120=1851·88	∴ 38 = 38·61	∴ 68 = 30·845	∴ 85 = 5·508

NOTE.—7000 grains troy=1 pound avoirdupois.

PRESSURE.

Metric to English.			English to Metric.				Atmospheric to English.		English to Atmospheric.	
I. Kilogrammes per square centimètre.	II. Pounds per square inch.	III. Tons per square inch.	IV. Pounds per square inch.	V. Kilogrammes per square centimètre.	VI. Tons per square inch.	VII. Kilogrammes per square centimètre.	VIII. Atmospheres.	IX. Tons per square inch.	X. Tons per square inch.	XI. Atmospheres.
1	14·223	·00635	1	·07031	1	157·49	1	·00656	1	152·38
2	28·446	·01270	2	·14062	2	314·99	2	·01313	2	304·76
3	42·668	·01905	3	·21093	3	472·48	3	·01969	3	457·14
4	56·891	·02540	4	·28124	4	629·97	4	·02625	4	609·52
5	71·114	·03175	5	·35155	5	787·47	5	·03281	5	761·91
6	85·337	·03810	6	·42186	6	944·96	6	·03938	6	914·29
7	99·560	·04445	7	·49217	7	1102·45	7	·04594	7	1066·67
8	113·783	·05080	8	·56248	8	1259·95	8	·05250	8	1219·05
9	128·005	·05715	9	·63279	9	1417·44	9	·05906	9	1371·43

Note.—One atmosphere is taken to be 14·7 lbs. per square inch.

Explanation.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point, and add together. Thus, find the number

of pounds per square inch in 32·1 kilogrammes per square centimètre (see cols. I. & II.).
kgs. per sq. cm. — lbs. per sq. in.
30 = 428·68
2 = 28·45
0·1 = 1·42
∴ 32·1 = 456·55

of tons per square inch in 3210 kilogrammes per square centimètre (see cols. I. & III.).
kgs. per sq. cm. — tons per sq. in.
3000 = 19·05
200 = 1·27
10 = ·06
∴ 3210 = 20·38

of kilogrammes per square centimètre in 15 lbs. per square inch (see cols. IV. & V.).
lbs. per sq. in. — kgs. per sq. cm.
10 = ·7031
5 = ·3516
∴ 15 =1·0547

of kilogrammes per square centimètre in 18·3 tons per square inch (see cols. VI. & VII.).
tons per sq. in. — kgs. per sq. cm.
10 = 1574·9
8 = 1259·95
0·3 = 47·25
∴ 18·3 = 2882·1

of tons per square inch in 3254 atmospheres. (see cols. VIII. & IX.).
atmospheres. — tons per sq. inch.
3000 = 19·69
200 = 1·31
50 = ·33
4 = ·03
∴ 3254 = 21·36

of atmospheres in 14·6 tons per square inch (see cols. X. & XI.).
tons per sq. in. — atmospheres.
10 = 1523·8
4 = 609·5
0·6 = 91·4
∴ 14·6 = 2224·7

ENERGY.

Metric to English.		English to Metric.	
I. Mètre-tons.	II. Foot-tons.	III. Foot-tons.	IV. Mètre-tons.
1	3·2291	1	0·3097
2	6·4581	2	0·6194
3	9·6872	3	0·9291
4	12·9162	4	1·2388
5	16·1453	5	1·5484
6	19·3743	6	1·8581
7	22·6034	7	2·1678
8	25·8324	8	2·4775
9	29·0615	9	2·7872

1 mètre tonne is termed a "dinamode" in Italy.

Explanation.—To convert any number from one measure to the other, take the values of the different multiples of 10 by shifting the position of the decimal point, and add together. Thus find the number

of foot-tons in 4367 mètre-tons (see cols. I. & II.).
mètre-tons. — foot-tons.
4000 = 12916·2
300 = 968·72
60 = 193·74
7 = 22·60
∴ 4367 = 14101·26

of mètre-tons in 3592 foot-tons (see cols. III. & IV.).
foot-tons. — mètre-tons.
3000 = 929·1
500 = 154·84
90 = 27·87
2 = ·62
∴ 3592 = 1112·43

SECTION IV.

TORPEDOES.

The Present Condition of Submarine Warfare.

Early history.

From the time of the first conception of the torpedo, or infernal machine as it was popularly called, by Captain David Bushnell in 1775, to the time of the civil war in America (1861–5), little or no attempt was made to utilise this class of weapons in a systematic manner, either for offence or for defence, in the many naval wars that have occurred during this period of nearly ninety years. In the gallant struggle for independence of the Southern States, however, these instruments, although of the most crude and imperfect construction, proved a terrible thorn in the side of the Federals, and were a supreme factor in enabling the Confederates to hold out for four long years, by placing in their hands the only available means of defending a considerable extent of sea coast, in the face of the overwhelming naval superiority of the Federals.

In the succeeding period of the last twenty-two years, naval wars of more or less magnitude have occurred; yet in the face of the fact of the greatly improved condition of both the submarine mine and the torpedo, these means of offence and defence have played practically but an insignificant part.

Cause of failure of torpedoes in recent wars.

This failure to realise the expectations formed from their effective employment in the American Civil War is principally due to the incapacity of the various Powers engaged in these later wars to grasp the lessons taught them by the Confederates.

Instances of failure to utilise torpedoes.

In the Russo-Turkish war (1877–8), by a systematic employment of the proper kind of torpedoes, under the direction of trained men, the passage of the Danube could have been rendered an impossible feat even to the Russians.

In the Franco-Chinese war of reprisals in 1884, the destruction of the Chinese ships and arsenal at Foochow by the French fleet might have been rendered a difficult and dangerous task had the Chinese been provided with the necessary means for a submarine defence, and for a torpedo attack, with the men capable of efficiently directing it.

Want of due preparation.

In these instances there is to be observed the same lamentable want of preparedness; no provision of the necessary material, no scheme of submarine defence, and no trained personnel prepared and perfected during peace time.

Condition of success in submarine warfare.

It cannot be too often repeated that it is an absolute condition of success in submarine warfare that the material thereof, such as mines, torpedoes, torpedo boats, &c., be manipulated by officers and men especially and carefully trained in their use. The most perfect system, and the most complete supply of material can only become efficient by continued and thorough practice, during peace time, with the systems and weapons that will be used in the time of war; while not only must there be a corps of skilled submarine miners and torpedoists, but a sufficiency of numbers as well.

Submarine warfare.

Submarine warfare consists of two branches, "defensive" and "offensive": the representative weapon of the former being the "submarine mine," and of the latter the "torpedo."

A submarine mine is actually a case of explosive anchored and fired beneath the surface of the water: being fixed, it is non-aggressive, and therefore is a purely defensive weapon.

A torpedo is literally a case of explosive possessing aggressive motion, and fired beneath the surface of the water.

Submarine mines.

Submarine mines consist of two distinct classes, viz. "self-acting" and "controlled": the former are fired by electrical, or by mechanical means, on being struck by a passing vessel, and being self-acting and uncontrollable, are as dangerous to friend as to foe, when once placed in an active state: the latter can be rendered at any moment active, or inactive; or, in other words, a harbour in which this class of mine is planted may be closed to the enemy, but open to a friend at any time, as may be required.

Torpedoes.

Torpedoes consist of five classes, viz.: "Spar," "Towing," "Drifting," "Controlled Locomotive," and "Uncontrolled Locomotive"; the spar and towing torpedoes are rendered aggressive by means of vessels or boats, either of special or of ordinary construction: the drifting torpedo by the current or tide by which it is carried to the attack: the locomotive torpedo of both kinds, either by motive power inherent in itself, as the Whitehead, Lay, Nordenfelt, &c., or developed at the point of departure, as in the case of the Sims-Edison Brennan, and others.

Every fighting ship and boat nowadays carries, as a portion of her equipment, torpedoes of some kind, usually the Whitehead, the Spar, or the towing torpedo, or a combination of them; the drifting and controlled locomotive torpedoes being restricted to providing a system of submarine defence with the means of offence.

DEFENSIVE SUBMARINE WARFARE.

Submarine defence has for its object the prevention of the passage of a harbour or river being forced by an enemy's ship or fleet rushing past the shore batteries, which in these days of heavily armoured high speed ironclads would be feasible, even in the face of the powerful guns now mounted in land works, in the absence of submarine mines; further, in the event of the land defences of a harbour planted with submarine mines being destroyed, the latter would still have to be accounted for, and cleared away or destroyed, before the harbour would be safely accessible to the ships of the enemy, causing a more or less serious delay dependent on the nature of the mine defence, and the means at the disposal of the enemy for executing an operation of this nature.

Protection of mine fields.

A mine field, *i.e.* the space occupied by a system of submarine mines, needs to be completely covered by gun fire, either mounted in shore batteries, or in guard ships, and should further be protected by armed boats; for, otherwise, any place in which a system of submarine mines has been planted, is practically at the mercy of the enemy, provided he has the time and means at his disposal for rendering it innocuous. Where self-acting mines alone constitute the system, greater trouble would be experienced by the enemy in destroying the defence, and more or less risk would always attend the use of a harbour that had been thus mined, because of the impossibility of knowing, with absolute certainty, that every one of these deadly weapons had been removed or destroyed. The enemy would, it may be presumed, be ignorant of the plan of the defence, and the number of mines laid down.

In the case of a harbour in which a system of controlled mines only had been laid, and which was left unprotected by guns, guard ships, or boats, the work of rendering the system inactive would be simpler and more sure, for here it would be only necessary for the enemy to discover and capture stations on shore from which the system is manipulated, to place the whole defence at his mercy; while supposing the defenders had taken the precaution to destroy the stations and bury the various electrical cables in connection with the mines, it would then be only necessary for the enemy to creep for these cables, and by under-running them, discover the whereabouts of the mines themselves, and then either destroy them, or leave them in position inactive.

It is as important to provide an adequate gun protection to the mine stations and mine fields of a system of submarine defence as it is to provide every fortified harbour with an auxiliary defence of submarine mines.

Self-acting mines. Self-acting mines are of two kinds, "mechanical," and "electrical;" the former provided with mechanical, and the latter with electrical firing apparatus.

CONTROLLED MINES.

Harbours of refuge. Controlled submarine mines are those which may, at any moment, be placed in an active or inactive condition at the will of the operator in the mine station on shore; thus a channel where such mines are planted may at any time be closed to the ships of the enemy, or opened to the passage in or out of friendly ships. Harbours defended by this class of mine are usually termed "harbours of refuge."

Difference between self-acting and controlled mines. The main feature of difference, between the self-acting and the controlled mine, is that in the case of the former its igniting agent is placed within or on the outside of the mine itself, while in the latter case it is placed in the mining station on shore, and consists of a firing battery so arranged that by the removal of a plug, or switching over of a key, it may at any instant be cut out of the circuit, thus rendering the mine inactive.

Classes of controlled mines. There are two classes of controlled mines, viz. "ground," and "buoyant": the former being placed on the bottom where it forms its own anchor: the latter being moored at the required distance below the surface of the water.

Present condition of the material of a system of submarine defence. The present condition of the material included in a system of submarine mine defence is unquestionably so far satisfactory for all practical purposes, that there cannot be said to exist any tangible reasons for delay in arriving at a definite decision as to its adoption for the defence of the ports, harbours and rivers of any country possessing a sea-board. Modifications and improvements may from time to time be suggested, but a harbour protected by a submarine mine defence, such as is now available, may be expected to be as well protected in ten years' time as it is at present. It may be that an explosive compound of higher power than, but as safe to handle and as reliable as, gun-cotton or dynamite (the explosive compounds at present in general use for submarine mining purposes) will be discovered; or it may be that some method of strengthening the bottoms of ships so as to decrease the effectiveness of the present mine charges will be invented; or again, it may be that some new principle of electricity will be unearthed, which shall revolutionize the present system of submarine defence; but notwithstanding all these and possibly other more or less important changes that the next ten years may see in connection with this branch of naval warfare, such will only perfect, not render the present system worthless. The point is that no country has now any legitimate excuse for putting off from day to day the work of providing a sufficiency of all the material that is necessary for the adequate defence of her sea-coasts, by means of submarine mines, on the plea that she is awaiting further developments.

Explosives.

For the charges of submarine mines, the explosive compounds "dynamite" and "gun-cotton" still hold their own as the best under all the conditions relating to their use in submarine defence, though recent information points to the possibility of nitro-glycerine satisfying these conditions in an even higher degree.

The destruction of a mine defence.

The submarine defence of a harbour, if the field of mines be completely covered by gunfire, and guarded by fast armed torpedo boats or steam launches, and if electric lights be properly placed so as to bring it at all times within the range of one or more of the beams of these lights, should be absolutely secure from destruction by the enemy; because, to effect the disablement or destruction of a mine field requires in the first place a fairly accurate knowledge of its position, and of the class of mine and system employed; and, in the second place, the absence of any decided opposition on the part of the defenders. The extreme difficulty of executing an operation of this nature in the face of a systematic defence is evidently the reason why no attempt has been made to devise new, or improve and perfect the old-established, methods of destroying a mine defence by creeping, sweeping, or countermining.

The operation of countermining consists in dropping a series of large mines by the enemy in what is supposed to be the defender's mine field, and then by exploding them together to clear away all the mines of the defence within a certain area, the extent of which depends, first on the number and size of the countermines, and secondly on the nature of the case, and circuit-closing apparatus of the mines in the field. The object of the countermines is to cause sympathetic explosions of the mines of the defence, or the disablement of their circuit-closers, cables, &c.

The advance that has recently been effected in the application of electricity to the propulsion of boats ought to be considered in any scheme of countermining, because such a motive power has the immense advantages for this and kindred operations of enabling a boat to be manœuvred with comparative invisibility and silence.

SUBMARINE OFFENCE.

The subject of submarine offence has always been a most fascinating one for inventors and others interested in the submarine branch of naval warfare, and to such an extent has their attention been absorbed by the development of the torpedo, as to cause the more passive and uninteresting submarine mine to be neglected; though the experience of the naval wars that have taken place during the last twenty-five years unmistakably points to the latter weapon as having rendered far more effective service than the former, on active service.

At the present time there exists a variety of classes of torpedoes, each class including a number of different kinds, few of which, however, have so far passed beyond the initial stage of private experiment, while some have been discarded for more advanced types, after years of service. Actually, at this date, the Spar and the Whitehead fish torpedo are the only kinds that can be said to be in general use.

Torpedoes may be divided into classes and types as follows :—

A. Drifting torpedoes.
B. Towing „
C. Projectile „
D. Spar „
E. Locomotive torpedoes { I. Uncontrollable. / II. Controllable.

A.—*Drifting Torpedoes.*

Drifting torpedoes.

The subject of drifting torpedoes has received but little or no attention of late years, and there is nothing to record as to any improvement effected in this direction. Though their use, in the American Civil War, was not attended with any success, yet they ought not to be looked upon as altogether worthless, owing to their cheapness and simplicity, as well as the ease with which extempore ones may be constructed ; further, their aggressive power (the currents and the tides) is provided by nature, and no risk of life or limb attends an attack by such means.

The demoralising effect would be very great if a number of these torpedoes, of proper construction, and arranged to be exploded by time fuses, were drifted into a harbour crowded with shipping, or up or down a river across which a force of the enemy was being conveyed in boats.

B.—*Towing Torpedoes.*

Towing torpedoes.

The towing torpedo was the outcome of a desire of torpedoists of twenty years ago to possess a submarine weapon capable of striking an enemy at a distance from the vessel manipulating it. It is said to have been suggested as far back as 1815, but it was reserved for Captain J. Harvey, R.N., to bring it into practical use in 1869, after many years of patient study and experiment, and this class of torpedo is usually known by his name.

The Harvey torpedo was first adopted by Russia in 1869, then by England in 1870, and after that by many other countries. In most instances the Harvey type of towing, or divergent torpedo, was adopted, and exhaustive experiments were carried on for years to perfect this particular weapon; but the United States, Germany, and France preferred to develop a special form of their own devising.

When the towing torpedo was first introduced, it was looked upon as a most effective weapon, both for offensive and defensive purposes, but it afterwards came to be considered purely as a weapon of defence, and its use in ships was restricted to acting as a deterrent against attacks by the ram.

The many favourable conditions necessary to afford this torpedo a chance of success, the great skill and judgment required in handling it (only to be obtained by constant practice), the introduction of the Whitehead, and, lastly, the complete failure of this weapon in the hands of the Russians in the war of 1877, all combined to cause the towing torpedo to be generally discarded. The French were the last to retain it, and in 1886 they most reluctantly gave it up. The retention of the Harvey for so many years, after its use had been condemned by naval men generally, and in the face of the advancing Whitehead, which though at that time most imperfect, yet was even then immeasurably superior to any type of towing torpedo, affords a striking proof of the exceeding difficulty of introducing a torpedo, which by its adoption necessitates the *discarding* of a well established but inferior one.

C.—*Projectile Torpedoes.*

Projectile torpedoes.

Torpedoes which are fired from a submerged gun in the same way as shot or shell are fired from an ordinary gun above water, and whose range is determined by the power of the gun, are termed "projectile" torpedoes.

The first known attempt of firing projectiles from a submerged gun was that of Fulton in 1814, who succeeded in piercing a wooden target placed at a distance of some 15 feet from the muzzle of the gun. The most recent attempt in this direction is that of Ericsson, whose submarine gun has been recently experimented with by our Government, with results unfavourable to this mode of firing torpedoes.

The trials of the Ericsson submarine gun in England were brought to an abrupt conclusion by the premature explosion of the torpedo in the gun, due, it is said, to the use of a fuse which had not been supplied by the inventor.

The submarine gun when operated from a ship labours under one great disadvantage, viz., the difficulty of knowing whether the gun is level at the moment of firing it, when the ship has any motion on, and if it be not so, its accuracy of fire is very seriously impaired.

In considering the foregoing classes of torpedoes, no description has been given of any particular type, because there is none in practical use, while those of classes A and B that have been tried are too well known to need to be further described here.

D.—*Spar Torpedoes.*

Spar torpedoes.

The spar, or as it is sometimes termed, pole or outrigger torpedo, is the simplest form of submarine offensive weapon extant; it has gained considerable notoriety from its successful application in the American Civil War, and it has been oftener used in actual war than any other kind of torpedo.

The introduction and rapid development of the Whitehead, however, created for a time a tendency among naval men to disparage the spar torpedo, owing to its want of range; and probably it would ere now have shared the fate of the towing torpedo, and been discarded as a weapon of naval warfare, had not the numerous successes recorded of its use by the French in China in 1884 caused the tide to turn again strongly in its favour.

These French successes with their spar torpedoes unquestionably prove that, under certain given conditions, this weapon is most effective and most deadly; as for instance, for the attack of a ship at anchor, unprovided with any kind of external protection such as nets, or booms, and where, by the absence of a proper look-out, the torpedo boat is enabled to get close up to the vessel before being observed.

For clearing away booms, and such like obstructions, across a harbour's or river's mouth, the spar torpedo will be found most useful; while it has the advantage of being cheap, simple, and readily adapted to any ordinary service boat.

All the ships that have so far been injured or sunk by torpedoes have met their fate at the hands of the spar torpedo, with the exception of one extremely doubtful case, in the Russo-Turkish war of 1877, when a small steamer is supposed to have been sunk by a Whitehead. This fact alone would seem a sufficient warranty for the retention of the spar torpedo, if only as an auxiliary weapon of submarine offence, for use under certain circumstances.

Since its first conception, the spar torpedo has received considerable attention with a view to simplify its fittings, to increase its effectiveness, and to insure an absolute certainty in its action.

The introduction of the higher explosives, dynamite and gun-cotton, in the place of gunpowder, the use of steel instead of wooden spars, the adoption of electrical ignition in the place of mechanical, and the development of the fast steam torpedo boat, have together combined to very greatly enhance the value of the spar torpedo, as a weapon of offence, in the present day.

E. I.—*Uncontrolled Locomotive Torpedoes.*

Uncontrolled locomotive torpedoes.

This class of locomotive torpedo may be said to be universally known through the agency of the world-renowned fish (Whitehead) torpedo, but though the latter has been adopted, in some shape or other, in nearly all the navies of the world, yet the *class* is imperfect, by reason of its feature of uncontrollability.

Two distinct types of torpedo are included in this class, viz. the Rocket and the Fish type.

Rocket torpedoes.

The history of torpedoes teems with attempts which have been made, from time to time, to utilise the gas evolved by the burning of a rocket composition as the motive power of torpedoes, but each succeeding attempt has only resulted in adding one more proof of the extreme difficulty, verging to almost impossibility, of ensuring the maintenance of a straight course, for even a run of only a few hundred feet, of a torpedo propelled by a rocket or rockets. Very frequently the experiments have been brought to an abrupt conclusion by the bursting of the motive power (the rockets).

The Whitehead fish torpedo.

The "Fish" type of locomotive torpedo is represented by the Whitehead (the Schwartzkopff is practically the same), the Howell, and the Paulson. Many other modifications of the Whitehead, differing in the matter of motive power and method of submersion, have been designed or proposed; but the above are, so far, the only types which have been actually made the subject of experiment.

The Whitehead, in common with all others of this class, suffers from one serious defect, viz. that it cannot be controlled in regard to its direction in an horizontal plane after it has been started on its run; therefore its *range of accuracy* is more or less limited, according to its speed and length of hull.

That this defect of the Whitehead is a very real one is proved by the fact that, although this weapon has been used on several occasions in war, yet only one instance is on record of its effecting the destruction of a ship, and even that one is open to much doubt; while innumerable instances could be quoted of a Whitehead failing to hit its target, during practice, in peace time.

The Whitehead may be controlled automatically in so far as arranging for its engines to stop after it has completed its run, and that it should then either float to the surface, or sink to the bottom; but considerable uncertainty attends these operations, as proved by the loss of a number of these torpedoes during experimental practice, by their *sinking* to the bottom instead of floating on the surface, at the end of the run. There must be always a certain element of danger in using this weapon in active service, from the possibility of its *floating*, instead of sinking, after missing the object aimed at.

In 1871 England purchased the secret of this invention and right to manufacture, consequent on the favourable results of experiments made with it during the previous year.

France, Germany, Italy, and other countries followed suit, until at the present time the United States is the only naval power of any consequence that does not possess the Whitehead torpedo.

The development of this torpedo during the last twenty years is seen from the following table:—

Date.	Length.	Diameter.	Speed.	Range.	Charge.
	feet.	inches.	knots.	yards.	lbs.
1868 . . .	14	16	6·7	650	60
1877 . .	14	14	20	600	37
1887 . .	14½	14	27	430	70

One of the principal causes which has enabled Mr. Whitehead to so greatly increase the speed of his torpedo, without also increasing its size, is that in the case of a *totally* submerged spindle-shaped body the laws of resistances for surface ships do not apply, and it has been found by actual experiments that, after once reaching the speed of 8 to 10 knots, the higher velocities are more easily attained.

The attainment of a high velocity is an important element of success in operating this type of uncontrolled torpedo, not alone because it enables the torpedo to reach the object aimed at in a short time, but also because the greater the speed the greater the accuracy of direction in an horizontal plane.

From the outset, compressed air has been the usual motive power for impelling a Whitehead through its launching tube when fired from ships, but now gunpowder seems to be coming into favour for performing this operation. In boats, the torpedoes were originally carried in skeleton tubes suspended from the sides, out of which, when lowered into the water, the torpedo propelled itself; then above-water enclosed bow-tubes and air impulse was used, followed by the Yarrow steam impulse; the former method again came into favour, only to be most probably superseded at no distant date by gunpowder impulse.

For small vessels, and torpedo boats where economy of space is an object, and now that the leakage from the reservoirs has been so greatly overcome, either the steam or gunpowder impulse has an advantage over air impulse, in not requiring any special apparatus such as air-compressing pumps and tube reservoirs. Objections have been raised against the use of gunpowder on the score that it fouls the launching tube, and by its sudden action is liable to damage the delicate mechanism at the tail of the torpedo; the action of gunpowder has the important qualification, however, of being more controllable than either steam or compressed air.

In ships various positions have been tried for the submerged discharging tubes, and numerous experiments have been and are still being carried out with tubes arranged to discharge Whiteheads, either right ahead or astern, or from the broadside from a ship moving ahead. At moderate speeds, up to 12 knots, no difficulties have been met with; but at high speeds, up to 18 knots, this operation is still attended with considerable uncertainty; in some recent trials torpedoes have been much damaged, and they are generally under these conditions more or less erratic in their course; thus increasing the defect inherent in this class of torpedo, of want of directive control, by destroying any likelihood of an accurate course at the very outset of its run.

The experience of a run of a number of French torpedo boats from Brest to Toulon in March, 1887, adds another possible doubt of the efficiency of the Whitehead on active service, as it was found that the constant pitching and rolling of the boats had affected the delicate adjustments of their torpedoes to such a degree that the trajectories of the torpedoes made angles up to 15° in a horizontal plane. This would not, of course, happen with those carried in ships, but it is a most serious evil, as most of the Whitehead work will have to be carried out from these boats, and in them no arrangements are at hand for verifying and correcting these adjustments.

The cleverness of the inventor in maintaining the principal action of the Whitehead as a secret, the immense sums of money that have been expended on this invention, the necessity of constructing special ships and boats to operate it, and lastly, the absence of a worthy rival invention, are some of the reasons which have so far contributed to retain the Whitehead as the principal arm of submarine offence of all but one of the naval powers of the world.

The Schwartzkopff fish torpedo.

The Schwartzkopff pattern of fish torpedo is almost identical with the Whitehead, differing from it mainly in regard to the material (phosphor bronze) of which the hull and working parts are constructed. This torpedo is the result of Germany's purchase of the Whitehead secret and the right to manufacture, and is the production of the Berlin Machine Building Stock Company, formerly I. Schwartzkopff, from whom it takes its name.

Schwartzkopff torpedoes have been kept for three consecutive weeks in the water, ready for running, and at the end of that time have run perfectly.

The Howell fish torpedo.

The Howell pattern of fish torpedo is the invention of Capt. Howell, U.S.N., and has for its main object the improvement of the defect inherent in the Whitehead, of want of directive power in a horizontal plane. The Howell differs altogether from the Whitehead in regard to its mode of propulsion, which is effected by the spinning of a heavy fly-wheel connected to the propeller shaft; the mode of controlling the submersion is in principle the same as in the Whitehead, but it differs somewhat from that in use in the latter in detail, and in the inclination of the horizontal rudder being brought about by purely mechanical apparatus, in the place of the air engine (servo-motor).

As at present perfected, the torpedo is 8 ft. long, 13·3 inches in diameter. The shell is of spun copper. Total weight 325 pounds, including 70 pounds of explosive. Guaranteed speed 23 knots for 200 yards, with a total range of 800 yards. The fly-wheel is of steel, weighs 110 pounds, and is spun up to 10,000 turns a minute, thirty seconds being required to attain that velocity. In larger models the proportion of charge to total weight will be about one-third.

The mechanical success of this weapon seems assured. In the last few years it has been subjected to trial before naval boards in the United States, and found to possess valuable qualities, chief among which may be mentioned its strong directive force and its comparatively small size. In recent experiments the diving apparatus also worked promptly and effectively. Besides the inherent directive force, the following elements of superiority are claimed for it over the Whitehead types: It is a much cheaper article; for the same size and weight it carries a much heavier charge; it does not possess the element of danger contained in the air flask, the rupture of which (by accident or hostile shot) has already been shown to be destructive to life and property; its track is not betrayed in daytime and clear weather by air bubbles. Granting that the humming noise is stopped, the remaining objectionable feature is the fact of its not lying in a state of constant dormant readiness, but having to be spun up before it is ready for use. It is claimed that this apparent defect does not exist to the extent stated, as when the wheel is once started it takes but little power to keep it going, and it can be spun up from the time of the vessel's going into action until hauling out.

Conclusions.

The "Whitehead" (in which may be included the Schwartzkopff) has been undoubtedly brought to a very high state of perfection, and will assuredly be accredited with many successes, *i.e.* with the injury and destruction of ships, in any future war between two Naval Powers fully equipped with this weapon and provided with the talent and means necessary to utilize it to the best advantage; but what will be the relative percentage of successes to shots fired, or relative percentage of the value of the damage caused by it to the enemy, in the shape of torpedo boats sunk and injured, and of torpedoes lost, as compared with the expense of using this torpedo, it is of course impossible to calculate or even conjecture with any degree of accuracy. Much may be said in favour of this torpedo; much yet remains to be done to it, and to its mode of application, to bring it to such a state of perfection as to strike a ship with certainty at, say, the very short range of 500 yards. This it is only reasonable to expect as the outcome of twenty years of development, and of unlimited expenditure of the public money of all those countries which have purchased the secret of the Whitehead and right of manufacture.

E. II.—*Controllable Locomotive Torpedoes.*

Controllable locomotive torpedoes.

In directive control in a horizontal plane the Howell type of Whitehead torpedo seems to be an advance on the latter; but it is impossible to correct the tendency of a floating body to move *bodily* out of its course by any automatic mechanism. Nothing short of personal control will effect this, and to this inherent defect of all "uncontrollable locomotive torpedoes" is due the impetus that has been given of late years to the development of an efficient weapon of the class under consideration.

There are two types of this class of torpedoes, viz. that in which the propelling power is self-contained, and that in which it is developed and applied at some fixed position external to the weapon.

Of the former type there are several inventions which have been brought more or less prominently to the notice of torpedoists during the last eighteen years, but only one of which can be said so far to have been adopted by any Government. This is the Lay torpedo, of which the Russian Government in 1883 purchased ten, and set up a home manufactory for their construction. The manufacture has been stopped, however, the Government being apparently contented with the original ten in their possession.

Improved Lay torpedo.

Mr. J. L. Lay has recently devised a new pattern torpedo, in which the principal novelty consists in the placing of the propellers in a recess in the bow. This torpedo was officially tried at Brightlingsea, in March 1887, but the performance was not successful, owing to its heeling over to such an extent as to bring the propellers out of water; this defect may probably be easily remedied. This weapon is cylindrical, with short conical head, and vertical wedge stern, 23 feet long, 18 inches in diameter, and weighs 1½ tons. It carries a charge of 200 lbs. of explosive in the cone head. It is run on the surface, but arrangements are provided for submerging it by admitting water, which can be driven out again by the gas.

The motive power is the same as in the original type of Lay, and is applied by means of a spherical engine. It is provided with two propellers on a common shaft, one loose, and the other fixed thereto; the former is made to revolve by an interlocking boss, when the latter has made half a revolution. In each propeller the two blades, instead of being on opposite sides of the shaft, are close together, the leading edge of one coming just behind the following edge of the other. Normally the two sets of blades are folded together, covering a sector of 70°, and stand upright within the recess in the bow where they work.

A speed of 16 miles is claimed, with a range of 2 miles.

The Lay-Haight torpedo.

The Lay-Haight torpedo was designed by Mr. Haight, formerly in the employ of Mr. Lay; it was constructed in 1881, and differs from the original Lay in drawing off the carbonic acid in a liquid instead of gaseous state, and in using a super-heater of sulphuric acid and lime. A speed of 15 knots was obtained with this weapon in 1883; but, except in the matter of increased speed, the Haight model is open to the same objections as the original Lay, in that it runs on the surface.

The Patrick torpedo.

The Patrick torpedo is in principle an improved Lay-Haight, run at a distance of 3 ft. below the surface by suspending it from a float.

The Nordenfelt electrical torpedo.

The Nordenfelt electrical torpedo, patented in 1883, possesses several novelties, and promises to be a most effective controllable locomotive torpedo. Its motive power is the electric current generated in a great number of small Electrical Power Storage Company's secondary cells carried in the torpedo and applied to the revolution of the propeller shaft by means of a Siemens' electric motor. The same battery supplies the power required for working the rudders.

The mode of submersion, peculiar to this torpedo, consists of two small wooden fins of special form, which are supported in the water by the hull; the latter possesses sufficient buoyancy to float itself in the event of the fins being knocked away.

Up to the present time nothing has been made public as to the progress of this invention, but it is stated that all the difficulties in connection with its successful working have been overcome, and that a new torpedo is nearly completed, in which will be embodied the experience gained from a series of exhaustive experiments with the original model extending over several years.

The Sims-Edison electrical torpedo.

The Sims-Edison electrical torpedo is a type of the class of controlled locomotive torpedoes in which the motive power for actuating its propelling engine is derived from a source external to the torpedo and conveyed to it, as in the Ericsson (compressed air), by a tubular cable, or in the Sims-Edison (electrical), by an electric cable, or as in the Brennan (mechanical), by steel wires. This class of torpedoes possesses one characteristic objection, in that they require to be operated from a fixed station on shore, but apparently this is not considered a serious defect by the English Government, as they have recently paid a considerable sum of money for the secret and sole right of manufacture of the Brennan torpedo for harbour defence.

The original type of this class was the Ericsson torpedo, 1873, in which the motive power was compressed air, conveyed to the motor by a tubular cable, but its short range, 800 feet, and slow speed, 3 to 4 knots, rendered it a most unpractical weapon.

The Sims-Edison torpedo is the outcome of the great advance that has been made of late years in the application of electricity for the propulsion of vehicles and vessels. The first of these torpedoes was experimented with in 1877, and proved successful in the matter of controllability and submergence, but was deficient in speed, only some 6 to 7 knots being obtained with this weapon.

In 1880, with an improved weapon, a speed of some 10 to 11½ knots was realised, and this weapon has been subjected to a series of most exhaustive experiments under the direction of General Abbott, U.S.A., with most satisfactory results in every particular, except speed.

APPENDIX.

COMMISSIONERS FOR EXECUTING THE OFFICE OF LORD HIGH ADMIRAL OF THE UNITED KINGDOM OF GREAT BRITAIN AND IRELAND, &c.

THE RIGHT HONOURABLE THE LORD GEORGE HAMILTON, M.P.
ADMIRAL SIR ARTHUR WILLIAM ACLAND HOOD, K.C.B.
VICE-ADMIRAL SIR ANTHONY HILEY HOSKINS, K.C.B.
VICE-ADMIRAL SIR WILLIAM GRAHAM, K.C.B.
CAPTAIN THE RIGHT HONOURABLE LORD CHARLES WILLIAM DELAPOER BERESFORD, C.B., M.P.
ELLIS ASHMEAD BARTLETT, Esq., M.P.

Parliamentary and Financial Secretary:
ARTHUR BOWER FORWOOD, Esq., M.P.

Permanent Secretary:
EVAN MACGREGOR, Esq., C.B.

Flag-Officers in Commission, Officers Commanding Squadrons, &c., Flag-Lieutenants, and Secretaries.

Stations.	Flagships.	Flag Officers.	Appointed.	Flag-Lieutenants.	Secretaries.
Nore . .	Duncan .	Vice-Admiral Charles L. D. Waddilove.	1 July 1887	Hon. Francis Spring Rice.	William B. Risk.
Portsmouth .	Duke of Wellington.	Admiral Sir George O. Willes, K.C.B. (Commander-in-chief.)	28 Nov. 1885	Henry R. P. Floyd.	Charles E. Gifford.
Devonport .	Royal Adelaide.	Admiral the Right Hon. Lord John Hay, G.C.B. (Commander-in-chief.)	25 May 1887	Francis H. Pollen.	George E. Marcon.
Queenstown. Ireland .	Revenge .	Rear - Admiral Hon. Walter C. Carpenter. (Senior Officer on the Coast of Ireland.)	1 Jan. 1887	Hans T. F. White.	Robert J. M.Macleod
Channel Squadron.	Minotaur	Vice-Admiral Sir William N. W. Hewett, V.C., K.C.B., K.C.S.I. (Vice-Admiral Commanding.)	18 Mar. 1886	Mark E. F. Kerr.	Henry C. W. Gibson.
	Agincourt	Rear-Admiral Charles J. Rowley. (Second in command.)	18 Aug. 1887	Guy A. J. Greville.	Robert Donaldson.
Mediterranean	Alexandra	Admiral H.R.H. the Duke of Edinburgh, K.G., K.T., K.P., G.C.S.I., G.C.M.G., K.C.B., G.C.I.E., AdC. (Commander-in-chief.)	5 Feb. 1886	Colin R. Keppel.	Henry H. Rickard.

FLAG-OFFICERS IN COMMISSION, OFFICERS COMMANDING SQUADRONS, &c., FLAG-LIEUTENANTS, AND SECRETARIES—*continued.*

Stations.	Flagships.	Flag Officers.	Appointed.	Flag-Lieutenants.	Secretaries.
North America and West Indies.	Bellerophon.	Vice-Admiral Algernon McL. Lyons. (Commander-in-chief.)	4 Sept. 1886	Hugh Evan-Thomas.	George Liddell.
	Urgent .	Commodore Henry Hand. (Commodore in charge at Jamaica.)	24 July 1886	None allowed	Joseph Green.
Pacific . .	Triumph	Rear-Admiral Algernon C. F. Heneage. (Commander-in-chief.)	20 Sept. 1887	Thomas W. Thynne.	Edward H. Banks.
China .	Audacious	Vice-Admiral Sir Richard V. Hamilton, K.C.B. (Commander-in-chief.)	1 Sept. 1885	Augustus L. K. Knapton.	Francis E. G. Dent
	Victor Emanuel.	Commodore William H. Maxwell, AdC. (Commodore in charge at Hong Kong.)	12 Feb. 1887	None allowed	Walter H. J. Pym.
East Indies .	Bacchante	Rear-Admiral Sir Frederick W. Richards, K.C.B. (Commander-in-chief.)	18 May 1885	Robert B. S. Wrey.	John Carlisle.
Australia .	Nelson .	Rear-Admiral Henry Fairfax, C.B. (Commander-in-chief.)	1 Feb. 1887	Seymour E. Erskine.	Charles J. Pawsey.
Cape of Good Hope and West Coast of Africa .	Raleigh .	Rear-Admiral Sir Walter J. Hunt-Grubbe, K.C.B. (Commander-in-chief.)	6 Mar. 1885	Charles M'Crea	Henry W. Paul.
S. E. Coast of America.	Ruby .	Captain William R. Kennedy. (Senior Officer.)	14 Dec. 1885	None allowed	
Training Squadron.	Active .	Commodore Albert H. Markham. (Commodore commanding.)	5 Nov. 1886	None allowed	Harry Robinson
Portsmouth Dockyard.	Asia .	Rear-Admiral John O. Hopkins. (Admiral Superintendent.)	1 Nov. 1886	None allowed	J. R. R Whitmarsh. (civilian)
Devonport Dockyard.	Indus .	Rear-Admiral Henry D. Grant, C.B. (Admiral Superintendent.)	10 July 1885	None allowed	W. T. Archer (civilian)
Chatham Dockyard.	Pembroke	Rear-Admiral Edward Kelly. (Admiral Superintendent.)	1 May 1886	None allowed	Edgar Besant. (civilian)
Malta Dockyard.	Hibernia	Rear-Admiral R. Gordon Douglas. (Admiral Superintendent.)	4 May 1887	Edward J. Bain.	James Bramble.
Admiral Superintendent of Naval Reserves.	Hercules	Vice-Admiral John K. E. Baird.	6 Sept. 1885	None allowed	William W. Perry.

Statement explanatory of the Navy Estimates, 1887-88, and of the Policy embodied therein.*

(*Presented to Parliament by Right Hon. Lord George Hamilton, First Lord of the Admiralty.*)

ALTERATIONS IN FORM OF ESTIMATES.

IT will be observed that certain changes have been adopted in, and additions made to, the form in which the Appendices to the Estimates have hitherto been drawn up. The primary object of these alterations has been to place before the House in the simplest form, the fullest possible information upon past and proposed future expenditure. Statements are also furnished in considerable detail of the capital stock of the nation in its Navy, Dockyards, and contents of the storehouses. These Statements will form the groundwork of a Capital Account which, it is hoped, may be presented in a more complete state next year.

In the detailed programme † of works to be undertaken during the year will be found under a separate heading for each vessel building particulars of her type, tonnage, load-draught, speed at mean-load draught, coal capacity, and armament as designed and approved. In the same column are shown the original estimated cost as well as the outlay as at present anticipated, also the amount of the expenditure on each vessel during past financial years, with the probable actual outlay during the year ending on 31st of March, 1887.

The total estimated cost of each vessel, including the estimated charge falling on Army as well as on Navy Votes, is also set out, thus affording information of the total outlay on the vessel complete for sea, exclusive of sea stores.

Hitherto it has not been customary to tabulate, in much detail, the proposed expenditure on the refit and repairs of vessels, it being impossible to give this information with the same approximation as with vessels building. Frequently the estimates are provisional. They are made prior to the arrival and full survey of the vessel, and often the necessity for outlay only developes during the progress of the work. At the same time, this class of expenditure forms so important an item in the 'Naval Budget,' that the fullest possible details are now given of the amount proposed to be allocated to each vessel. The value of such outlays depends largely upon the character of the ship and her probable efficiency after alteration and refit as a vessel of war. Information is, therefore, now furnished, which will enable an opinion to be formed upon these points.

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* Parliamentary Paper No. 173.

† Appendix to Navy Estimates.

The ordinary repairs and maintenance on the Channel and other squadrons and the estimated cost of miscellaneous Services are summarized separately. The Appendix also exhibits the proposed expenditure in the aggregate compared with the Votes.

The Vote for dockyard labour is taken in the present Estimates as a whole, and is not allocated, as has been the practice in past years, to the several Yards. The object of this change is to afford the Controller of the Navy more latitude in the distribution of work, and of the classes of labour, in a manner which may promote greater efficiency and economy in carrying out the varying requirements of the Navy.

The statement following the Appendices, is the first of the series of Tables framed for the purpose of informing Parliament of the value of the property which the nation possesses in the Navy, and the Establishments and Services connected therewith.

In the Table showing the cost of the Navy will be found the name of each effective ship in the Navy with the year of her completion, original cost of construction, and subsequent total expenditure upon alterations, refits, and maintenance. Vessels which have become inefficient, but which remain on the list, or those not worth the cost of immediate repair, or which have become obsolete, are placed in a separate category in the Summary, as also is the cost of troop and harbour ships, as well as of yard and other craft belonging to the Service.

The "Explanations of Differences," which have been previously printed as a separate Parliamentary Paper, are this year included, for the convenience of Members of the House, in the Navy Estimates.

PRESENT CONDITION OF NAVAL FINANCE.

EXPENDITURE OF 1886–87 AS COMPARED WITH ESTIMATES 1887–88.

The expenditure (including both Original and Supplementary Estimates) borne by Naval Votes for the year ending 31st of March, 1887, is £13,270,100.

The estimate of expenditure for the year ending 31st of March, 1888, is £12,476,800, being a decrease of £793,300 compared with the expenditure of the preceding year. A reduction of expenditure generally implies a decrease of the effective strength of the service with which it is connected. We are fortunate enough to be able to reverse this rule in the present instance. The reduced outlay during the ensuing financial year is accompanied by a material increase in the strength of the Navy, money being found for 62,500 officers and men in 1887–88 as against 61,400 in the preceding year, whilst the number and power of ships in the 1st Reserve, and ready for commission on 1st of April, 1888, will be much in excess of any similar provision for many years past.

A diminution in the amount of liabilities for vessels and engines constructed by contract is another notable feature in the present financial Statement.

These liabilities stood at £2,680,000 in April 1886, and are estimated to be £1,030,000 in April 1887; yet at the end of the financial year 1887–88, including the cost of new ships and engines contracted for during that year, they will stand at the low figure of £431,000. An almost similar reduction of liability for ships building in the dockyards can be shown.

The large augmentation in the fighting strength of the Navy which will have been effected simultaneously with a reduction of annual expenditure and incurred liabilities may be accepted as a proof that naval finance, so far as outlay and return are concerned, is now in a satisfactory condition, and that it will be possible, under a system of judicious management, to associate for some time to come a reduction of expenditure with an increase of efficiency.

REVIEW OF THE LAST SIX YEARS' EXPENDITURE.

These satisfactory results have been attained partly by policy, partly by improved methods of administration; but a careful review of the expenditure of the past six years is necessary, in order that the significance of our present position, and the causes at work in establishing it, may be understood by Parliament and the country.

In the period between 1881 and 1885 every Naval Power in Europe, save England, largely increased its naval expenditure. The introduction of slow-burning powder, and the alterations in the design of heavy ordnance which it entailed, whilst giving increased velocity and accuracy to guns of all calibres, produced a corresponding development in the defensive power of armour-clads and protected vessels. Speed in the performance of naval tactics became an even more essential factor than before, and was so recognised abroad: and on vessels of comparatively small displacement successful efforts were made to realise, by engineering ingenuity, a speed wholly unknown to the smaller craft of a few years back.

These developments of speed and power necessitated increased expense.

England was the last Naval Power to recognise these new conditions. In 1885, under popular pressure, the Government of that day admitted the insufficiency of its previous arrangements, and, with the assent of all parties in the State, Lord Northbrook, the then First Lord of the Admiralty, proposed to expend, in addition to the ordinary shipbuilding programme, a sum of £3,100,000 in the building of ships by contract in private yards. An additional sum of £1,600,000 for guns was also proposed to be added to the Ordnance Votes of the Navy, which are included in the annual estimates of expenditure of the War Office.

The Chancellor of the Exchequer estimated that this outlay would be spread over five years, ending 31st of March, 1890, and form a portion of the expenditure of the country for that period.

The work has been executed with such rapidity, that nearly the whole of this expenditure has fallen upon three, instead of five, years. Moreover, the sum of £3,100,000 was found to be insufficient to complete the work it began.

The following Tables show the difference between the estimate of time and outlay made in 1885 and the actual expenditure of the past two years, and the probable disbursements in the ensuing year.

NEW CONSTRUCTIONS.

Special Programme.

	1885–86.	1886–87.	1887–88.	1888–89.	1889–90.	Total.
	£	£	£	£	£	£
Hulls and Engines (Contract price)	800,000	800,000	500,000	500,000	500,000	3,100,000

Expenditure—Actual and Estimated.

	1885–86. (Actual.)	1886–87. (Actual and Estimated.)	1887–88. (Estimated.)	Balance remaining.	Total Cost.
Hulls—	£	£	£	£	£
Contract price . . .	701,150	861,701	518,023	74,093	2,154,967
Completing	1,572	71,721	154,470	64,032	291,795
Propelling, &c., machinery	341,428	274,437	127,331	52,546	795,742
Gun-mountings . . .	12,282	68,289	118,555	25,628	224,754
Torpedo apparatus . .	16,551	43,384	78,957	969	139,861
Total . . .	1,072,983	1,319,532	997,336	217,268	3,607,119

Comparison of Expenditure (estimated) with Programme.

	Programme.	Expenditure.	Difference.
	£	£	£
Hulls and engines	3,100,000	2,950,709	− 149,291
Completing	..	291,795	+ 291,795
Gun-mountings.	..	224,754	+ 224,754
Torpedo apparatus	..	139,861	+ 139,861
Total	3,100,000	3,607,119	+ 501,819

Memorandum.

Lord Northbrook's special Shipbuilding Programme, as provided for in the Estimates 1885–86, included—

2 Armourclads.
5 Belted Cruisers.
6 Steel Torpedo Cruisers.
10 first-class Torpedo-boats (4 subsequently added).

The financial result of Lord Northbrook's special programme may be summarised thus:—

1. An excess expenditure of £502,000 on the original ship-building estimate, which provided for hulls and engines only.

2. An expenditure on account of ships building of £3,390,000 in *three* years, instead of an expenditure of £3,100,000 in *five* years.

3. An extra expenditure (under Army Votes), roughly estimated at £500,000, for the ammunition and torpedoes necessary for these ships, and for which no special provision was made.

VOTE OF CREDIT OF 1885.

Soon after the proposals for this increase to our naval strength had been assented to in 1885, the prospect of a possible war compelled the Government to apply for a large vote of credit, of which

£2,000,000 * was appropriated to naval purposes. A large additional sum was also granted for the manufacture of naval ordnance, and included in the Vote of Credit allotted to the War Department.

A considerable amount of orders and of work were given under these Votes of Credit, which were not covered by the sum allotted to them, and have since become a charge upon the annual Estimates.

These are the causes of the exceptional expenditure of the past two years, for during that period Navy Votes have had to meet not only the ordinary want and wastage of a great Service, but the accumulated arrears of an antecedent period of insufficient provision.

A comparison between the average expenditure of the four years ending the 31st of March, 1885, and the two years ending the 31st of March, 1887, makes this inequality very apparent.

AVERAGE EXPENDITURE OF 1881–85 COMPARED WITH 1885–87.

The average annual expenditure upon the Navy (deducting the Transport Vote, which is for services rendered to the Army) of the four years ended the 31st of March, 1885, when all the Naval Powers in Europe, except England, were so busy, was:—

	£
Navy Expenditure	10,628,000
Gun ditto † (Army Vote)	738,000
Total average annual expenditure for four years ending 1884–85	11,366,000
In 1885–86 Navy expenditure was	14,724,000
Gun ditto † (Army Vote)	1,600,000
Total, 1885–86	16,324,000
In 1886–87 Navy expenditure (estimated) was	12,941,000
Gun ditto † (Army Vote)	1,685,000
Total, 1886–87	£14,626,000

being a total excess during the two years of £8,218,000 over and above the average expenditure of the four preceding years.

If this great sum had been spread over this period of six years more evenly, and if consideration and a continuous policy had attended its disbursement, the Navy at this moment would be far stronger than it is.

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* Exclusive of £500,000 for transport (Army Department).

† Includes estimated value of services performed by War Office, beyond actual provision for Navy in original Army Estimates.

On the other hand, the increase of strength which this sum will ultimately give, would have been more economically attained if hurry and scare had not attended its outlay.

The conclusion to be drawn will, I trust, not be lost sight of by subsequent Administrations and by Parliament.

SHIPBUILDING POLICY OF THE PRESENT BOARD.

Although three successive Boards of Admiralty have been in office since 1885, the policy pursued, so far as shipbuilding and dockyard administration are concerned, has been uniform and continuous. The enormous liabilities and the great number of ships ordered in 1885 induced the Board of July 1885, of which I was the Head, to concentrate their attention to bringing to as rapid a completion as it was possible the programme of shipbuilding they found prescribed, without enlarging it; certain gaps in it were filled, and the vessels laid down for that purpose were in most instances of small displacement, and absolutely necessary to provide for the reliefs of the next and subsequent year.

The following Statement shows the progress made both in the past and that contemplated in the forthcoming financial year.

PROGRESS OF SHIPBUILDING AS COMPARED WITH PROGRAMME 1886–87.

Completed Ships.

In the Estimates for 1886–87 it was anticipated that the following new vessels would be "passed into the 1st Reserve" during the financial year :—

3 armoured ships.
1 protected ship.
13 unprotected ships.

According to the latest Reports, it appears that the actual figures for the ships named in Appendix No. 37, as to be completed in 1886-87, will stand at the end of March 1887 at one armoured ship, one protected, thirteen unprotected.

Two armoured ships—Rodney and Warspite—have not been completed as was intended; the Warspite, because of changes in rig and certain details, resulting from experience with Impérieuse at sea; the Rodney because of delays in supply of guns and gun-mountings.

Three unprotected ships—Fearless, Lizard and Bramble—have been delayed in delivery by contractors, and, consequently, have not been completed by the date they would have been had contract terms been kept.

Besides the ships that have been completed, or will be finished in 1886–87, it is anticipated that thirty-five out of the fifty-five first-class boats of 125 feet to 150 feet in length will be completed in 1886–87; the remaining twenty torpedo boats are complete in armament, and will be ready for service in June.

Furthermore, it must be noted that out of the sixteen ships shown as to be passed into 1st Reserve in 1885–86 (Appendix 37, Navy Estimates for 1886–87), fully one-half (including 2 armoured, three partially-protected, three unprotected ships) had money spent upon their actual completion in 1886–87.

The whole addition to the fleet in 1886–87, excluding small craft, has therefore been:—

3 armoured ships.
1 protected ship.
3 partially protected ships.
13 unprotected ships.

Under the Orders issued by the present Board, every vessel when passed into the First Class Reserve is supposed to be ready for sea in forty-eight hours, and the officers of the respective yards are held responsible that all vessels so passed are maintained in that condition.

Advancement of New Ships.

The general character of the work done on new ships in 1886–87, besides the completion of those above named, may be best described as *rapid advancement.* For the dockyard work, the facts are set forth in the draft programme for 1887–88, the most notable examples of rapid progress being the Trafalgar, Nile, Immortalité and Aurora. Results have amply justified the decision taken in framing the Estimates for 1886–87 to make *liberal provision* for the expenditure on labour on each of these vessels.

Causes of Delay on New Ships.

Some difficulties have arisen, as was anticipated, from the circumstance that so many of the armoured ships laid down previous to 1885 are very nearly in the same stage of advancement towards completion, requiring hydraulic machinery and gun-mountings simultaneously. Until the Collingwood's barbette-mountings had been actually tested, work on the corresponding mountings for other vessels of the Admiral class could not be taken in hand. When these trials were completed the orders given for other ships were of exceptional magnitude and urgency, greatly taxing the resources of the manufacturers.

The great exertions which the contractors have made to improve their means of meeting these demands render it improbable that there will be in future a recurrence of delay from ships being in advance of their gun-mountings.

Delays in delivery of guns by the War Office have also affected the completion of some ships.

Contract Work, 1886–87.

The work on new ships building by contract has been pushed forward with great rapidity, and the sums earned have exceeded those provided in the Estimates for 1886–87.

During the financial year there have been delivered :—

6 torpedo cruisers (Archer class).
1 torpedo cruiser (Fearless).
4 composite gunboats (Rattler class).

Four out of the five belted cruisers have been launched, and the fifth is to be launched on the 10th March. It is anticipated that the first of these vessels will be delivered early in 1887–88, and that all of them will be in the dockyards next summer, and it is hoped that they will all be completed by April, 1888.

The Renown and Sans Pareil are also advancing rapidly. The former is to be launched in April, and the latter in May, 1887, two years from the date of signing the contract.

The Benbow has been delivered by the contractors, has made her steam trials, and is now being completed at Chatham.

The six torpedo cruisers of the Archer class recently delivered have given some trouble in their preliminary steam-trials, and their completion has consequently been delayed. It is hoped, however, that two of them will be practically completed this financial year, and the others advanced. It may be anticipated that their speed on the measured mile will be 17 knots.

The Fearless, sister ship to the Scout, was delayed by a fire at the contractor's premises, otherwise she would have been completed this financial year.

Torpedo Flotilla.

Passing to the smaller vessels of the torpedo flotilla, the Rattlesnake has been delivered and tried, attaining a speed of 19½ knots, the estimated speed being 19 knots. It is probable that by changes in propellers a better performance will be obtained.

This vessel is the first of the "torpedo gunboat" class. She was practically completed at the works of the contractors, and will speedily be ready for her sea trials, which will furnish very important information.

Now that her machinery trials are over, the other three vessels of the class building in the dockyards will be pushed on.

EXPERIMENTAL TRIALS OF NEW SHIPS, 1886-87.

During 1886-87 the sea trials of two important armoured ships, the Colossus and Impérieuse, have been made. In the Colossus very few alterations have been suggested as the result of experience at sea. In the Impérieuse, and following her, in the Warspite, it has been decided to abolish the sails, and to depend entirely upon steam-power applied to twin screws.

With the important exception of being more deeply immersed than was anticipated, the Impérieuse in her trials fully realized the expectations of her design. Notwithstanding her deep draught, she is now, taking the essentials of speed, armament, and armour into consideration, if not actually the most powerful, one of the most powerful ironclad cruisers afloat of her tonnage.

Sails have also been removed from the Neptune during her present refit, in order to increase her efficiency as a fighting machine.

The protected cruiser Mersey has been completed and sent on experimental service to test systems of submarine torpedo discharge. Her steam trials, and those of her sister vessels, Severn and Thames, have shown the class to possess a smooth-water maximum speed of 18 knots.

The first of the torpedo cruiser class, the Scout, has also been completed and commissioned in 1886-87, as well as the torpedo gun-vessels Curlew and Landrail. Both of these represent new classes in the Navy.

TRIALS OF TORPEDO BOATS.

Some interesting trials have been made during 1886-87 with the various types of first-class torpedo boats 125 feet in length. These trials led to a modification in the form of the bow and in the torpedo armament of twenty-five of the boats. Great exertions have been made to accelerate the completion of the boats, the work on the torpedo fittings being of a novel and delicate nature, and only twenty will, it is anticipated, be incomplete in small fittings at the end of March, the torpedo armaments of these being finished.

The 150 ft. boat purchased of Mr. White is practically completed, and the 135 ft. boat, by Messrs. Yarrow, will be delivered in 1886–87. These examples of larger-dimensioned boats will furnish useful information when tried at sea, as to how far they will comply with the conditions of a sea-going torpedo boat available for use in all weathers.

DECISION OF THE BOARD UPON SEA-GOING TOREPDO VESSELS AND SECOND-CLASS TORPEDO BOATS.

The Board have carefully considered the types and dimensions of the torpedo boats, which experience and experiment have shown to be best adapted for sea-service or harbour defence. The practical tests during recent evolutions imposed upon first-class torpedo boats, that is, boats intended for open-sea service, and upwards of 100 ft. in length, have shown that they could not, in actual warfare, stand the strain of the daily wear and tear to which they might be exposed. The discomfort and hardships which their crews have to endure in rough weather, the loss of speed to which, after steaming a certain number of hours at full pressure, they are subject, owing to the tendency of their necessarily-contracted boiler tubes to choke, disqualify boats of these dimensions from taking the prominent part in warfare in the open sea which their adherents claimed for them. The Board have therefore decided in future to build for sea-going purposes vessels of larger dimensions, capable of acting both on the offensive and defensive in torpedo warfare in the open sea. These vessels to be of the Rattlesnake type, capable of maintaining for many hours the initial speed of the ordinary torpedo boat, armed with quick-firing guns, and another gun of a larger calibre, and affording adequate accommodation and protection to the complement they carry for sea-going purposes.

The Board have decided upon adopting a new type of second-class torpedo boat, capable of being lifted on board ships of a certain displacement, and which would be carried by the ship for service in the place of the larger or first-class torpedo boats which now are supposed to accompany a squadron.

The 125-ft. torpedo boats now building or built have, in most instances, been allotted to the defence of the great military ports and coaling-stations, where they will remain.

Two improved boats of the second-class have been ordered from Messrs. Yarrow, and are to be completed in a short time.

Important experiments have also been undertaken with a view to determine the most suitable torpedo armament for boats.

DEFENCE AGAINST TORPEDOES.

During 1886–87, great attention has been given to the development of defence against torpedo attack. A Committee has been investigating net defences; several of our battle ships are already fitted with this system of torpedo defence, and further experimental fittings are being tried on the Hercules and Collingwood.

The torpedo experiments on the Resistance have also afforded valuable information as to the explosive power of the torpedo.

ELECTRIC LIGHTING.

Electric lighting, for search-lights and internal illumination, has also been greatly extended. A staff of skilled supervisors and fitters for electrical work has been organized in each dockyard.

PROGRESS IN SHIPBUILDING IN 1887–88.

The coming financial year will be very remarkable for the great number of ships which will be completed and added to the effective list. It may be anticipated that the following ships will be finished, and passed into the 1st Reserve, as ready for commission:—

Armoured ships	10
3 of Admiral class—Rodney, Howe, Benbow.	
Warspite.	
Hero.	
5 belted cruisers (contract-built).	
Protected ships	2
Severn.	
Thames.	
Torpedo-cruisers	7
6 of Archer class.	
Fearless.	
Torpedo gunboats (Rattlesnake class)	3
Composite sloops and gunboats (Buzzard and Rattler classes)	3
	25

At the end of 1887–88, another armoured ship, the Camperdown, will be nearly finished, and so will be the protected cruiser Forth. The Anson will be approaching completion.

The belted cruisers Immortalité and Aurora will be far advanced; the Trafalgar and Nile will be the great causes of further liability.

The Renown and Sans Pareil are to be delivered, according to contract, in October 1888, and if no unforeseen hindrances arise, there is good reason to believe this date will be kept.

Out of 37 ships, building or incomplete, at the commencement of 1887–88, it is hoped 26 will be complete by the end of the year, leaving only nine out of the programme of 1885, and two other ships not belonging to this programme, to be finished in subsequent years.

New Ships to be Laid Down in 1887–88.

The new programme of works proposed for 1887–88 includes the following:—

20-knot steel-bottomed protected cruisers, at Chatham	2
19¾-knot copper-bottomed protected cruisers, 2 by contract and 1 at Portsmouth	3
Composite sloop (Buzzard)	1
Composite gunboats (improved Rattlers)	6
Grasshopper class	1
	13

Of the Rattlers it need merely be said that they differ from the Rattler herself only in having a poop, being about 1 foot broader, and of about 40 tons greater displacement. The steam trials of Rattler and Wasp have been very satisfactory, speeds of 13½ to 13¾ knots having been obtained.

The new Buzzards are "repeats" of the Buzzard now building at Sheerness—speed on the measured mile, 15 knots.

Both the Rattlers and the Buzzards have a fair amount of sail, and coppered bottoms. Rattlers have single screws; Buzzards, twin screws.

To the ships included in the above programme should be added the Daphne, composite sloop of the Buzzard class, which, although not forming part of the programme in the Estimates of 1886–87, has been already commenced at Sheerness. The preparations made in 1886–87, though involving small expense, will enable the work to be pushed on rapidly in 1887–88.

POLICY TO BE PURSUED IN REGARD TO SMALL VESSELS.

These gunboats and sloops have been laid down to make provision for the relief of small vessels on different stations during the next two years. A careful inquiry into the composition of our squadrons abroad has made clear that too large a proportion of our naval strength is absorbed by small vessels, which, however well adapted for police purposes in time of peace, or for operations in shoal water and rivers in time of war, would be of comparatively little value for the protection of our commerce on the high seas in time of war. I believe that, in course of time, arrangements can be contrived with the Foreign and Colonial Offices by which a limited number of larger and more powerful vessels, moving from place to place on the station, can be made to efficiently perform the work of the more numerous but less movable flotilla now employed. All the vessels now laid down have a speed equal to, if not in excess of, any of their class elsewhere, and will therefore be a match for anything of like displacement which they might encounter, and the new 20-knot protected cruisers about to be commenced will be faster than any ocean war cruisers in the world at present completed, and, consequently, of the highest possible value for the protection of our commerce.

DESCRIPTION OF 20-KNOT PROTECTED CRUISERS.

The most notable vessels proposed to be laid down in 1887–88 are two 20-knot protected cruisers.

Their dimensions are:—

Length	265 feet.
Breadth	41 „
Displacement	2800 tons.
Speed on measured mile, with 400 tons of coal, and fully equipped	20 knots.
Ocean speed	17 to 18 „
Radius of action at 10-knot speed	8000 „

The vessels will have a protective steel deck extending from stem to stern, and sheltering the boilers, magazines, steering-gear, &c.

Vertical (inverted-cylinder) triple-expansion engines are to be fitted in the steel-bottomed ships, special arrangements of armoured-coamings being built for the protection of that portion of the cylinders.

Above the protective steel-deck the space will be minutely subdivided, coal-bunkers, coffer-dams, &c., being built as is usual in vessels of the "protected" class.

A double-bottom on the cellular principle, adapted for water-ballast, will be fitted.

The armament will include—

6 6-in. B.L.R. guns on centre-pivot mountings.
9 6-pr. rapid-firing guns.
Machine guns.
6 Torpedo tubes (all under cover).

The bow will be strengthened for ramming in the usual manner.

In all respects the vessels will be made suitable for independent sea-service, and for being driven at high speed in rough water.

They will have only fore and aft steadying sails, being dependent upon their steam-power and twin-screws for propulsion.

THREE COPPER-SHEATHED 19¾-KNOT CRUISERS.

It has been decided to vary the design in three of the vessels in the following particulars:—

1. To wood-sheathe and copper the bottoms, so as to make the vessels capable of remaining afloat for long periods without serious fouling and consequent loss of speed.

2. To adopt horizontal engines, placed entirely below the protective deck.

These changes involve an increase in displacement and a slight decrease in maximum speed which are accepted in view of the special services for which the vessels are intended.

In armament, protection, and all other qualities, the conditions are the same in these as in the steel-bottomed ships.

The trials of these vessels will be made under the new regulations, with all weights aboard.

CONDITIONS UNDER WHICH SPEED TRIALS OF VESSELS ARE CONDUCTED.

The speed and other trials of the ships recently built, together with the working of their engines and hydraulic mountings, have on the whole been satisfactory. In most instances the anticipations of the constructors have been realized, although difficulties have occurred in some of the earlier trials in obtaining from certain of the engines the speed of the contract. In one important particular there is a discrepancy between the estimate of the original design and its result, which, in the case of the Impérieuse, and her sister vessel the Warspite, attracted some attention, and which is likely to recur in the case of the belted cruisers, seven in number, the Warspite, and the armoured vessels of the Admiral class.

The following statement, though referring to the belted cruisers alone, is typical of all the vessels whose draught is deeper than was designed; and it will also record the Regulations as to design and trial which the present Board have made. (See Appendix I. page 537.)

The designs for the belted cruisers were prepared in 1884, and the sketch design received the final approval of the Board of Admiralty during that year.

It was intended that, with all their legend weights on board, they should have a mean draught of 21 feet, and that 18 inches of the armour belt, which is 5 ft. 6 in. in width, should be above water.

After the designs were approved, tenders for the construction of five vessels were invited. Some of these tenders provided for the substitution of triple-expansion engines of 8500 horse-power in place of the compound engines of 7500 horse-power originally contemplated, and the advantages of the offer were so manifest that it was decided to adopt this type of engine for all five ships.

To compensate for the increased weight entailed by these engines, and in view of the economy in fuel that would result from their adoption, it was decided to reduce the legend weight of coals to be carried by 60 tons; this placed the legend weight of coals at 440 tons, in place of the 500 tons originally approved.

The extra weight of the engines, of increased complements, and of armament, amounting in all to 186 tons, increased the draught of the ships by 7 inches, placing the top of the belt 11 inches out of the water.

It appears to have been decided, although the bunkers of these ships were constructed to hold 900 tons of coal, that 500 tons (afterwards decreased to 440 tons) should be taken as the amount they were to carry under ordinary conditions—in other words, as their normal supply of fuel.

It was calculated that this amount of coals would carry the ships about 4500 knot at 10 knots an hour, and with this the Board of Admiralty at that time appear to have been satisfied.

The present Board, however, are of opinion that it is far preferable that ships should carry to sea with them the largest amount of coal they are able to carry.

If the whole of the 900 tons, with the additional weights alluded to, be placed on board, instead of 440 tons, the top of the belt will be, on the ships first going to sea, 6 inches below the water.

Thus, although the position of the belt may have been correctly calculated for the weight of coals it was at the time decided to carry, and which was adopted as their deliberate policy by the then Board of Admiralty, the same is undesirably low if coals to the full stowage (which is the policy of the present Board) are put on board.

Though the policy which placed the position of the belt so low does not commend itself to the present Board, it is right to say that some claim for it certain compensating advantages, their contention being—

(1.) That there would be above the armour belt, running along 140 feet of its length, when the full fuel supply is on board, a coal protection of 6½ feet in height and of 11 to 17 feet in depth.

(2.) That the coal protection would not be disturbed until, by the consumption of coal in the lower bunkers, the ship had lightened, and the armour belt had risen above water.

(3.) That a shot, which during a roll might have struck below the belt, would, in its present lower position, be deflected.

From the only trial under steam which has yet taken place with one of these vessels, there is every reason to believe that the speed for which they were intended will be attained, with the ships fully equipped and the bunkers full.

LEGEND WEIGHTS.

The principle adopted by successive Boards of Admiralty since 1870 of selecting as their legend weight of coal, in new ships that they proposed to build, an amount considerably less than that which the bunkers were constructed to carry, originated when compound engines began to be used in Her Majesty's ships.

The substitution of improved engines for the older types effected such an economy of fuel in relation to the engine-power developed, that a very much less quantity would carry a ship so fitted the same distance as a ship of identical form and size with the simple engines previously in use.

This seems to have influenced the Admiralty to accept, when designing new ships, as the legend weight of fuel, a quantity which gave as great a radius of action as was possessed by earlier ships, though it was at the same time decided to provide for exceptional conditions by the construction of reserve bunkers.

Explanation of Difference in Draught and of New Regulations.

The difference, therefore, between the draught of the vessels enumerated, with their coalbunkers full, and with all weights on board, and that contemplated in their original design, arises from two causes:—

1. Because it had been the practice that only a portion of the coal the vessel is capable of carrying should be on board at the time of her speed-trials. The present Board disapprove of this practice as misleading. The vessel in question (Impérieuse) was officially stated to be capable of either steaming 2000 knots at the rate of 17 knots per hour, or 8000 knots at a lower speed. If all the coal were on board necessary to give the coal endurance for the longer distance, the higher speed could not be attained; if the coal were reduced to allow of the higher speed, the longer distance could not be covered. Directions have been given by which, in future, speed-trials will be for twenty-four hours with all weights aboard, in addition to the present trials of six hours with reduced weights.

2. The other reason for increase of weight is that, at the time the design was passed, sufficient allowance was not made for the number of complement, weight of guns, machinery, and engines. If fuller consultation had taken place between the designer and the officers responsible for these weights and details before the ship was laid down a more accurate estimate could have been made, and the extra weights afterwards found necessary would have been anticipated. Regulations insuring this co-operation have now been made, and will be found in Appendix I. page 537.

Summary of Increase to Fleet, 1886–87 to 1887–88.

The number of vessels added during 1886–87, and the contemplated increase during 1887–88, are given in the following Table:—

Class of Ship or Vessel.	1886–87.		1887–88.		Total.	
	Number.	Tons.*	Number.	Tons.*	Number.	Tons.*
Armoured ships . . .	3	25,690	10	67,990	13	93,680
Protected ships . . .	1	3,550	2	7,100	3	10,650
Partially-protected ships	3	11,250	..	..	3	11,250
Unprotected ships . .	16†	16,130	13	14,980	29	31,110
Total . . .	23	56,620	25	90,070	48	146,690

* Load displacement.

† Includes Hearty (1300 tons), Jackal (750 tons), and Bann (250 tons).

This addition to our fleet is abnormally great; but the fleet previous to this increase was abnormally weak. Having therefore brought up our naval strength, so far as ironclads and cruisers are concerned, to what is generally admitted to be requisite, we have next to consider the annual expenditure (for depreciation or wastage) necessary for the maintenance of the fleet in that state of efficiency.

VALUE OF FLEET AND ESTIMATE OF ANNUAL EXPENDITURE NECESSARY FOR REPLACEMENT.

The administration of the Navy cannot be satisfactory unless the approximate wastage or depreciation is so ascertained, as to afford reliable data upon which to predicate the extent of shipbuilding requisite in each year to maintain the fleet at its present authorized strength. The advantages of such a knowledge, and of basing a continuous naval policy thereon, are manifest.

One obstacle to securing economical results from the dockyards has been the spasmodic action in regard to the extent of the new work. The Controller of the Navy, as a great employer of labour, has, in consequence, been unable satisfactorily to regulate the employment of men and the distribution of work to the different trades. If the extent of tonnage to be laid down at each yard from year to year were known with any degree of accuracy, the necessary men of the several trades connected with shipbuilding could be employed, and the vessels could be commenced, in such rotation, and at such intervals, as would permit the men of a certain trade to move from ship to ship, as their particular description of work was completed.

The Table * in the Appendix to the Navy Estimates which gives the cost and date of completion of each vessel affords a basis upon which to calculate the approximate annual percentage of depreciation on the value of the fleet arising from decay or supersession, the latter being a most important factor.

It must be kept clearly in mind that this Table is drawn up so as to indicate the year of completion of each ship, and her cost is placed under that year, and is not distributed under the years in which the expenditure, as it progressed, was provided. This arrangement is necessary for the purpose of arriving at a proper conclusion, because a vessel cannot, as a rule, be regarded as subject to depreciation until she is complete for service. In calculating the depreciation, and the

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* See p. 562.

period for which it ought to be charged, regard must also be had to the value remaining in the vessel after the expiry of the given number of years of her probable life. Whenever a vessel is sold, her realized value should, therefore, be credited to Navy votes in aid of new construction, in order to carry out the principle here advocated.

Subject to the foregoing considerations, the following is a reasonable scale upon which to fix the annual depreciation for the different classes of vessels which form the Fleet, and to provide the minimum sum which should be invested annually in the production of new tonnage, viz.:—

1. On armoured, protected, and partially-protected iron or steel vessels, for twenty-two years from date of completion, 4 per cent.

2. On corvettes, sloops, torpedo-cruisers, gun-vessels, gun-boats, troopships, and other vessels, for fifteen years, 6 per cent.

3. On torpedo boats, steam-launches, &c., for eleven years, 9 per cent.

4. On small vessels, tugs, and yard craft, for eighteen years, 5 per cent.

5. On guard, receiving, training, and harbour vessels, for twenty-two years, 4 per cent.

An element in determining the amount upon which depreciation ought to be calculated is the normal standard of strength at which the Navy is to be maintained. The leading feature adopted in the following Table is the special programme decided upon by Lord Northbrook in 1884, as sanctioned by Parliament, and his ordinary programme for the year 1885–86. These were framed on the proposition that the Navy was then much below the requisite strength, having regard to the protection of British interests. Therefore, in ascertaining the capital cost of the Fleet on the 31st March, 1887, all the vessels completing, which were commenced by Lord Northbrook, are regarded, *so far as depreciation for replacement is concerned*, as if finished on that day. The Nile and Trafalgar are, however excluded, as their completion is somewhat remote, and the expenditure upon them may be viewed as a part of the ordinary charges for shipbuilding required in subsequent years. These propositions appear the more reasonable as no new vessels were laid down in 1886–87, thus assisting more clearly to draw a line between expenditure to make up prior deficiencies, and that necessary to maintain the agreed standard of efficiency.

Following the foregoing line of argument, and applying it to the cost of the Fleet, the following approximate results are obtained:—

		£	£
1. Armoured, protected, and partially-protected iron or steel ships—			
At present on strength of the Navy, at first cost .		19,417,000	
Add cost of new ships not yet completed—			
Expenditure to March 31, 1887 (probable actual)		6,240,000	
Remaining to complete (estimated) . .		2,248,000	
Total . . . . . £		27,905,000	
Deduct—	£		
Cost of ships completed prior to 1865-66	378,000		
*Estimated value of gun-mountings, &c., included in above figures .	1,300,000		
		1,678,000	
Net total capital cost of armoured, &c., ships necessary to maintain the Fleet at normal strength .		26,227,000	
Proposed annual depreciation for replacement, say at 4 per cent. per annum on £26,227,000 . .		..	1,049,000
2. Corvettes, sloops, torpedo-cruisers, gun-vessels, gun-boats, troop-ships, and other vessels—			
At present on strength of the Navy, at first cost .		7,386,000	
Add cost of new ships not yet completed—			
Expenditure to March 31, 1887 (probable actual)		587,000	
Remaining to complete (estimated) . .		443,000	
Total . . . . . £		8,416,000	
Deduct—	£.		
Cost of ships completed prior to 1872-73	1,572,000		
*Estimated value of gun-mountings, &c., included in above figures .	200,000		
		1,772,000	
Net total capital cost of corvettes, &c., necessary to maintain the Fleet at its authorized strength .		6,644,000	
Proposed annual depreciation for replacement, say at 6 per cent. per annum on £6,644,000 . .		..	399,000
3. Torpedo-boats, steam-launches, &c.—			
At present on strength of Navy, at estimated first cost		1,500,000	
Proposed annual depreciation for replacement, say at 9 per cent. per annum on £1,500,000 . .		..	135,000
Carried forward . . .			£1,583,000

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* Gun-mountings, &c., are excluded from the above calculations, as provision has only of late years been taken for the greater part of them in the Navy Estimates and is voted separately. If the cost is in future included in the cost of the ship, depreciation should be calculated thereon at the same rate as on the ship.

	£	£
Brought forward	..	1,583,000
4. Small vessels, dockyard tugs, tanks, &c.—		
At present in the Service, at first cost	448,000	
Deduct cost of vessels completed prior to 1869–70	202,000	
Net total capital cost of small vessels, tugs, &c., necessary to be maintained	246,000	
Proposed annual depreciation for replacement, say at 5 per cent. per annum on £246,000	..	12,000
5. Receiving, training, guard, and harbour ships, &c.—		
At present in the Service, at first cost	3,270,000	
Deduct cost of vessels built prior to 1885–86	2,963,000	
Net total capital cost of vessels built since 1885–86	307,000	
Proposed annual depreciation for replacement, say at 4 per cent. per annum on £307,000	..	12,000
6. First cost of ships completed since the commencement of the periods referred to for the several classes, which are at present laid up as obsolete, or for sale,* also of ships completed within those periods (excluding the older types of armourclads of wooden construction), which have been sold, lost, or otherwise disposed of	4,359,000	
Proposed annual depreciation for replacement as if these ships still formed part of the strength of the Navy, say at an average of 4½ per cent. per annum on £4,359,000	..	196,000
Grand Total (Annual Depreciation for Replacement by New Construction)	..	£1,803,000

That this estimate of £1,803,000 as the minimum amount of new construction (exclusive of gun-mountings and special fittings) required to meet the annual depreciation or wastage of the Navy is fair and reasonable is confirmed by an examination of the data given in the Appendix before referred to.

The aggregate expenditure on vessels added to the Navy from 1865–66, and upon those now in course of construction in completion of Lord Northbrook's programme, on which £1,186,000 remains to be expended, is £39,119,100, or an average of £1,778,000 per annum expended on new construction. This is exclusive of the cost of gun-mountings, &c., and of all expenditure upon the Nile and Trafalgar, which, although included in Lord Northbrook's programme, have, for reasons already explained, been omitted from the preceding calculations.

In many of the years preceding the adoption of Lord Northbrook's special programme in 1884, the rate of construction was much below this average; consequently, provision to meet these deficits has mainly fallen upon the estimates of the three succeeding years.

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* Of the vessels built during the period of this return, a number have already been sold, lost, or laid aside as obsolete, not being worth the cost of alteration to suit modern requirements in regard to speed, armament, &c. In order, however, that the Depreciation Fund may be adequate to maintain the normal strength of the Navy, the amounts expended on construction of such vessels must also carry a depreciation for the period set out in these tables, even if, owing to exceptional circumstances, the vessels have been prematurely removed from the list.

The Estimates for 1887–88 include the sum of £997,000 to be expended on account of the special programme undertaken, as already stated, to place the Fleet in a normal condition of strength, leaving a balance to be met in future years of £217,000. These sums will be thrown upon the taxpayers in excess of the amounts they would have been called upon to bear had previous administrations provided year by year all that was needed. The contemplated expenditure upon new vessels (including the Nile and Trafalgar, but excluding £396,000 for gun mountings, &c.), beyond the sum of £997,000, amounts to £1,665,000, or £138,000 less than the annual requirement to meet wastage, as already explained.

Considerations such as these prompted me last year to propose in Parliament that a certain portion of this exceptional expenditure should be converted into a terminable annuity, and spread over a period of years to afford some immediate relief to the taxpayer. The suggestion was not favourably received, the arguments directed against it being that during peace the income of each individual year must bear its own burden of expenditure. If this contention be sound, that no year is to be relieved of any portion of the expenditure properly debited against it, then Parliament, by enactment or otherwise, should insure the reverse of that proposition, that no year is to escape its fair annual share of the depreciation fund necessary to keep our Navy efficient. If this depreciation and wastage fund be fixed at the figure which, on the most careful analysis, is found to be by actuarial calculation necessary, and legally forms part of the annual charge upon the Exchequer, it would not be possible, hereafter, for the national capital invested in war ships to be deliberately reduced by a misappropriation or abandonment of the annual expenditure necessary to replenish it. A continuous and economical and efficient shipbuilding policy would be possible, and the waste and discredit occasioned by periodical scares would be avoided.

DOCKYARD ADMINISTRATION.

The alterations commenced in 1885 for the purpose of securing a more efficient management and control over the employment of labour and the appropriation of material in the yards have worked well, and have more than justified the anticipations formed of their ultimate utility. The appointment of a Director of Dockyards has strengthened from an executive, and that of an Inspector of Yard Accounts from a financial point of view, the control of the Admiralty over dockyard business and expenditure. Simultaneously with the creation of these offices, a system of improved local management has been inaugurated, whereby the Admiral Superintendents have been furnished with competent professional assistance in the management of the dockyards. Arrangements have been made by which the professional officers are enabled to obtain rapidly, and, if necessary, direct from the contractors, the supplies they may require, and they will be made responsible for proper check and account of the outlay incurred under their superintendence. An improved and more accurate form of estimating repairs has been instituted, facilitating a detailed check over this class of expenditure. Substantial savings have been made in this annual outlay. Steps have been taken whereby the incidental expenditure, at one time forming almost a third of the outlay of the yards, will be regulated and classified; numerous obsolete but expensive returns have been abolished, and an inquiry into the number of the clerical staff and those employed in writing duties has been instituted, which should lead to a considerable reduction of the present establishment. In the meantime, I have given directions that no vacancies in the Admiralty and dockyard clerical staffs should be filled, as there is reason to believe both are redundant.

In the course of these inquiries it has been made clear that the number of workmen in the various yards is in excess of the work to be performed. The Board have therefore commenced to bring down the establishments to the necessary level; it is, however, satisfactory to know that though the number of *employés* has diminished, the output of work per man has increased, and the demand for, and consumption of, material used in proportion to the men employed, is on the increase.

COST OF REPAIRS OF SHIPS.

A considerable proportion of dockyard expenditure is absorbed in the periodical repairs of vessels in commission. A close scrutiny of the list of defects sent in by officers commanding ships, and forwarded for sanction to the Admiralty, showed that a certain amount of the work proposed to be done in the dockyards might have been performed by the carpenters and artificers forming part of the complement of the ship. In other cases, sufficient care had not been exercised in criticising the list of defects before being sent to the Admiral Superintendent. The attention of officers has been directed to this practice by a circular dealing specially with this subject, and which will be found in Appendix II., page 539.

YARD ESTABLISHMENTS.

At the close of the financial year 1887–88 the liabilities outstanding on new construction will be small compared to those of recent years. Careful prevision will, therefore, be necessary as regards the programme of work for 1888–89 and subsequent years, and arrangements will be made to utilise, as far as is possible, the existing dockyard establishment, though the cessation of the building of armoured and protected vessels of large displacement will necessitate some ultimate reductions. Provision in the present estimates is made for fifty-three instead of fifty-two weekly payments to all *employés* in receipt of weekly wages, as within the 366 days of the financial year such a number of weekly payments become due.

NEW WORKS, &c.

Upon the average annual sums hitherto expended for the maintenance and extension of the buildings, basins, and graving docks of the home and foreign dockyards, a considerable reduction has been effected this year, the object of the Board being to secure the thorough utilisation of all existing buildings before giving their sanction to an enlargement of the present accommodation.

GRAVING DOCKS ABROAD.

The policy of subsidising companies to build docks abroad capable of taking in and repairing men-of-war of large dimensions has been favoured of late years by successive Boards of Admiralty, and considerable sums have in this manner been spent in past years. The dock at Esquimalt, thus assisted, will this year be open and ready for use; at Hong Kong the final instalment for a similar purpose will this year be paid; and at Halifax arrangements have been made by which it is hoped like advantages will hereafter accrue, on the completion of the dock.

The multiplication of graving docks in colonial territory in different parts of the world will greatly advantage the ships of the Navy, as it facilitates the execution of repairs and cleaning, which, if undone, might incapacitate a man-of-war from active service.

The conditions under which Government assistance towards the construction of docks is given, is that, when constructed, payment shall only be made for services or work rendered.

NAVAL ORDNANCE.

There is a large increase in that portion of the estimates taken by the Army for the supply of naval ordnance for 1887–88. This is attributable to a necessary provision of ammunition for quick-firing guns, the amount being £313,429 as against £42,150* in the approved estimate of 1886–87. This increase is mainly due to the provision of ammunition for quick-firing guns being reduced in last year's estimates. By the postponement of this liability from last year the Navy has been compelled to make inconvenient demands this year upon Army estimates, it being impossible to allow a large number of guns provided to be useless for want of ammunition; a large increase in the expenditure upon naval ordnance, and a consequent advance in the requirements of the Navy, have, in the last two years, taken place, and the naval armaments of this country now compare very favourably with those of foreign countries. Until 1880 the muzzle-loaders of the British Navy were about equal in accuracy and penetration to breech-loading guns of foreign nations. Since then the development of slow-burning powder has necessitated the production of a breech-loader different in shape from, and far superior in the high velocity it imparts to the old breech-loader. The only breech-loaders in the British service, with the exception of a few 40 and 20-pounders, are of the most modern type; the great bulk of the breech-loaders in foreign service are of the older type, and fairly comparable to the old muzzle-loaders of similar calibre.

The Table attached shows the yearly increase since 1886 in modern breech-loaders and quick-firing guns, and torpedoes available for service:—

Date.	B.L. Guns.	6-pr. Q.F.G.	3-pr. Q.F.G.	Torpedoes.
April 1886 . . .	711	..	..	1,224
„ 1887	1,019	315	298	1,514
„ 1888	1,281	342	448	1,818

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* A further sum of £100,000 for this service has been taken in the Supplementary Army Estimates, 1886–87.

The question of transferring the cost of providing naval armaments from Army to Navy Votes has occupied the serious attention of both Departments during the past year. A Committee of the officers of both Departments carefully considered the bases of a transfer. Every information and assistance was given to the Admiralty by the War Office with the object of facilitating such a change. So extensive a transfer involving the annual expenditure of upwards of a million and a half of money ought not, in our opinion, to be made until the machinery for the administration and control of this outlay are so perfected at the Admiralty as to enable the assumption of this responsibility to be discharged with effect and without increased charge. To place one Government Department towards another in the relation of purchaser and manufacturer is no easy matter. The proportion of establishment charges to be added to the cost of labour and material on different articles of manufacture varied from 10 to 40 per cent., according to the class of work performed. Any mistake in fixing prices between Woolwich and the Admiralty would affect all contract work done elsewhere, as Woolwich prices regulate the price of gun manufacture in this country. Further difficulties also arose in reference to the storage, issue, and testing of the stores proposed to be transferred. For these reasons we pressed upon the War Office the desirability of postponing the proposed change, until sufficient time had been afforded for the full consideration of the many complex details involved in this question.

PERSONNEL OF THE NAVY.

The reports of the efficiency of officers and men are satisfactory. The number of Courts-martial has diminished, whilst the amounts deposited and number of depositors in savings-banks have increased. The health and physique of the men have improved. By the Return of the wastage of men (blue-jackets, 19,000 in number) we find during the last four years a continuous decrease in the annual waste:—

1882–83	2,446
1883–84	2,368
1884–85	2,062
1885–86	1,942

This diminished waste has upset the previously-accepted calculations, by which provision, through the entry of a certain number of boys in the training-ships, is made to keep the number of seamen up to the authorized strength. There is a certain excess over that number, but steps have been taken to reduce the number of boys entered for training.

The Navy now seems to be a very popular Service. A high standard and restrictions on number of entries have been imposed to prevent an undue influx of boys, but the competition is, notwithstanding considerable. It is worthy of note that, simultaneously with the growing popularity of the Navy with parents as a career for their sons, there is a dread of dismissal from the Service which previously did not exist. Mutilations and misconduct not unfrequently in the past were deliberately adopted for the purpose of insuring dismissal, whereas the present tendency is in the opposite direction.

During the last ten years, owing to the multiplication of engines and machinery in ships, a large increase has taken place in the artificer, engine-room, and stoker complements. Comparing the year 1876 with 1886, it will be found that the combatant class has decreased, so that the proportion of non-combatants to combatants is much larger than before:—

	1876.	1886.	Difference.
Officers, executive . .	2,300	2,120	— 180
„ non-executive .	1,955	1,718	— 237
Warrant officers . . .	903	952	+ 49
Blue-jackets* . . .	19,586	18,667	— 919
Artificers	2,420	2,569	+ 149
Engine-room staff . .	4,279	6,983	+ 2,704
Others†	4,474	5,269	+ 795

Steps have, therefore, been taken to have all stokers trained to the use of arms, the same reward being held out to them to become trained men as had been given to seamen and marines; arrangements have also been made to substitute marines for the civilian butchers, barbers, and lamp-trimmers now afloat; this will entail an increase of marines corresponding to the number of men they replace.

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* In 1876 blue-jacket class included 500 masters-at-arms and ships' corporals, now included among "Others."

† Masters-at-arms, ships' corporals, stewards and cooks, writers, sick-berth staff, &c.

EDUCATION OF EXECUTIVE OFFICERS.

The Report of the Committee on Education has been considered, but not accepted in its entirety. The age for entry in the Britannia has been advanced six months, and in a year's time will be advanced six months more.

A Council of Education has been instituted to consider certain questions connected with this subject, and to recommend necessary alterations from time to time. It is intended to revise the seamanship examination, to bring it in accordance with the requirements of the present day, and to lay more stress on the acquirement of a knowledge of steam machinery, and of French and other modern languages. The education and training of a young officer lasts from his entrance into the Britannia to his passing out of the College at Greenwich, an interval on the average of about seven and a-half years. During a large proportion of that time he is afloat, discharging responsible duties. The desire of the Board has been to insure, as far as is possible, continuity of instruction and training during the whole of this period, so that at no time it may be necessary for an officer to relearn that which he had acquired and forgotten.

An improved curriculum of study and practical work has been passed for the Engineer Students at Portsmouth and Devonport.

NAVAL RESERVES.

The Regulations both for officers and men of the Royal Naval Reserve have been revised and consolidated. Provision has been made for bringing the Royal Naval Reserve into closer association with the Service by allowing officers and men to volunteer for service in the Navy, either in sea-going ships or for a course of instruction in the Gunnery and Torpedo Schools. The officers who undergo a year's training in a sea-going ship are to receive, while they remain on the Active List, an annual retaining-fee of £20 to £25 a year. Both officers and men are showing readiness to avail themselves of these opportunities, and in order to facilitate their doing so, it has been arranged that the Sub-Lieutenants, Royal Naval Reserve, who are of a certain age, shall, in order to enable them to mess with officers of similar age, be granted the temporary rank of Acting Lieutenants.

An important alteration in the Regulations has been introduced, by which men can, in time of emergency, be allowed to volunteer for service without being called out by Royal Proclamation.

The enrolment of stokers for the Royal Naval Reserve has not hitherto proved so successful as was anticipated, but this was owing, probably, to insufficient advertisement of the new scheme.

Some alteration in the regulations, combined with a fuller knowledge of the advantages held out, will, it is believed, lead to a great increase in the number of firemen coming forward to enter the Reserve, especially under the stimulating influence of the arrangements recently made with the White Star and Cunard Companies.

DEVELOPMENT OF INTELLIGENCE DEPARTMENT.

Although many of the component and complementary parts of the Navy are in themselves satisfactory, it has long been felt by naval men of experience and foresight that in the event of war, unless an improved system of co-operation and preparation were devised, the nation would not obtain, in the earlier stages of such a contest, the full advantage of its great naval resources. This opinion was confirmed by the experience of 1885. Confidential reports of what then occurred proved that our power of naval mobilisation was most defective. A rapid concentration of strength, and an immediate and effective use of the force thus brought together, have in recent years decided within a few weeks of the outbreak of war the ultimate issue of that war.

Important as it may be for a great military nation to be thoroughly prepared for possible contingencies, the necessity for thorough preparation is even more incumbent upon a Power that is supreme at sea.

A mobilisation of land forces is local and territorial in its operation; the mobilisation of naval resources must be concentrated at the few naval arsenals capable of fitting out and commissioning the ships of which they are the complement. A great Naval Power has no frontier; the limits of its operations are confined by the ocean alone, and the plan of campaign or of operations which it may have to carry out, would differ in every quarter of the globe, according to the strength and geographical position of the enemy against which it was contending. On land, the plan of campaign or strategy to be adopted is regulated by the physical conditions of the country, which do not change, and by the fighting strength of a population, which does not shift. All well-organised Military Powers have derived infinite advantages from a properly-constituted Intelligence

Department; but the need, as I have shown, for such an organisation, is greater for naval than military purposes. This country has the largest fleet afloat, yet hitherto it has had no central organisation by which that fleet could be thoroughly utilised in emergency.

The Board therefore determined to enlarge and extend the functions of the late Foreign Intelligence Committee, and place it upon a basis equal to the work which in future it will be required to perform.

During the short period it has been in existence it has done good work. The Reserve and other subsidiary forces have been territorially mapped out, and each district has been assigned to one of the three great naval arsenals in the country. Much work, necessarily of a confidential character, has also been done, and although the continuance of such a department will entail a certain increase of expenditure, there is no outlay connected with the Naval Votes which the nation or the Navy could less afford to dispense with than that which will enable the full strength of our naval resources to be put forth in as short a time as possible, and will give prompt and efficient co-operation to all the component parts of a Navy stationed in the necessary performance of its duty in all quarters of the globe.

The Intelligence Department will be under the personal superintendence and control of the First Naval Lord, but all questions will be referred to the other Naval Lords, which relate to, or affect the departments for which they are respectively responsible.

The Naval Lords will meet periodically to discuss and review what has been done, thus making themselves acquainted with the nature and extent of the enlarged duties, which in an emergency, they and the departments they administer would have at once to undertake.

UTILISATION OF AUXILIARY RESOURCES.

The inquiries, which an Intelligence Department must needs make, brought before the Board in forcible contrast the great disproportion between the volume of floating commerce of the Empire to be protected, and the force at present available to protect it, compared with the mercantile and war marine of foreign nations. To bring the British Navy and commerce into the same relative proportion as that which exists elsewhere in Europe is neither needed nor practicable. To carry out a plan which, at the approach of war, would immediately convert our fastest and most powerful merchant-vessels into effective war-cruisers, and thus turn the assailed into assailants, seemed a natural solution of the difficulty; but there were various obstacles to its realisation. The cost of retainers, the difficulty of providing crews and stokers, the delay in the alterations necessary, the contingency that when wanted, the vessels might be at the other end of the world—these difficulties in combination deterred previous Boards from making the experiment.

The enormous sums spent in taking up vessels in 1885, many of which never left harbour, and the long delay in getting the guns and fittings in the Oregon, the only vessel thoroughly equipped of all those hired, impressed upon my colleagues and myself the duty of taking some action in the matter. Exceptional speed and strength are the only desiderata of a mercantile cruiser. It occurred to us that the Post Office expenditure might be utilised, and that if we worked in combination, postal contracts could be associated with conditions by which the use of the vessels carrying the mails might under certain contingencies be economically secured to the State. The revision of the North American contract was a most favourable opportunity for a trial of the idea. The White Star Company, one of the tenderers, had, in August last, expressed their willingness to build two vessels to be approved by the Admiralty, of a speed and strength superior to any merchant-ship afloat, with engines and boilers below water, with fittings for guns built in during construction, and, when manned, with half crews of Naval Reserve men.

In return for their use, the Company requested an annual subsidy which would recoup the owners a portion of the larger outlay the exceptional construction of the vessels required.

The Cunard Company, another of the tenderers, has the fastest English ships afloat. A large portion of the officers and men in the employ of the Cunard Company are Naval Reserve men. Their ships are never more than eight days distant from Liverpool, and, therefore, always obtainable at short notice.

The Admiralty, after full consultation with the Treasury and Post Office, commenced negotiations with these two Companies.

They were influenced greatly by this consideration, that merchant-vessels, when armed, to be really serviceable, should have exceptional speed and coal capacity, enabling them to overhaul the weak and to escape from the strong.

Such exceptional speed entails a primary cost in engines and boilers, and a consumption in coal that renders the remunerative employment of the vessel very difficult. Only a few of the richest and best-conducted passenger lines can afford to build such vessels, and the profits derived from their employment in recent years have been small.

Unless some inducement is given by the English Government to continue the building of such vessels, they must diminish in number, whereas abroad, by subsidies, their construction is directly encouraged. It is neither to the credit of the country, nor for the advantage of our marine, that vessels of this class should mostly be under foreign flags.

The arrangement made with the two companies differs in detail, but is the same in principle.

By the payment of an annual subsidy, reduced one-fourth so long as the mail contract lasts, the Government obtain from the Cunard Company the use of the Aurania, Etruria and Umbria, in time of emergency at a price fixed both as regard hire or sale. The necessary platforms and fittings for carrying guns are to be put in at once; the crews of the ships to be half Naval Reserve men; the owner to take charge of the gun mountings required. Under this arrangement, it is believed that within a week all three vessels could be fitted, armed, stored, and manned as armed cruisers. The use, at fixed prices, of the remainder of the Fleet, if required, was a secondary condition of the contract.

With the White Star the arrangement was practically the same, except that no payment was to be made till the two new ships to be built were ready for sea.

By this arrangement the Admiralty have obtained, at a moderate annual cost, the use for five years of the three fastest steamers afloat, and two even faster, when constructed.

Negotiations with the Australian Colonies have for some time past been carried on, which, though not concluded, will, we hope, result in those countries contributing towards an extension of the Imperial Navy, and maintaining, as an integral part of the fleet, an Australian squadron, in addition to the force which has hitherto been stationed in those waters.

CONCLUSION.

The past year has been one of unusual activity. Many of the changes and reforms I have enumerated have been prompted and carried through by the personal interest taken in them by individual members of the Board. The Heads of the Departments have heartily co-operated with the Board in their endeavours to place naval administration on a more business-like and efficient footing.

What has been done makes apparent how much still remains to be effected before the condition and organisation of our Navy can be said to be thoroughly satisfactory. The completion of the large ironclads and cruisers mentioned before renders that portion of our fleet more efficient, but by contrast makes still more apparent the obsolete and unserviceable condition of the great majority of our gunboats and sloops.

The very improvements, that recent changes have made, show how large a field for reform there still remains in parts of our naval system which have not yet been touched.

GEORGE HAMILTON.

February 28, 1887.

APPENDIX I.

PROCEDURE TO BE OBSERVED WITH REGARD TO THE PREPARATION OF DESIGNS OF HER MAJESTY'S SHIPS.

1. Cases having recently been brought to the notice of my Lords in which the immersion of a ship when complete for sea will be seriously and prejudicially affected by reason of introduction during construction of additions and alterations to the hull, machinery, complement, armament, &c., the procedure hereafter defined is to be strictly observed.

2. When a design of a ship is required, the Controller will furnish the Board with a general idea of the class of vessel required.

3. The Controller will, after conferring with the First Naval Lord, and obtaining his written approval as to the speed, armament, complement and sail power, if any, instruct the Director of Naval Construction to prepare a sketch design for consideration embodying such features as may have been decided upon by the First Naval Lord and the Controller.

4. The Director of Naval Construction, after conferring with and obtaining the opinion in writing of the Director of Naval Ordnance and the Engineer-in-chief as to the armament and machinery respectively, is to prepare a sketch which shall be submitted to the Controller, who will bring the same before the Board.

5. If the sketch design is generally approved by the Board, orders will be given by the Controller that the design is to be worked out in detail, or modified with a view to its ultimate adoption. (The sketch design will be prepared in accordance with the following

Board Minute of the 21st September, 1886, relating to load draught.)

6. The Director of Naval Construction will, in consultation with the Director of Naval Ordnance and the Engineer-in-chief, complete the design and submit it with a full and careful description of the expected qualities and capabilities of the ship for the concurrence of the Controller, by whom it will be sent to the Secretary for circulation to the several members of the Board, before being considered at a Board meeting.

After a design has been approved by the Board, and has received the Board stamp, not any alteration or addition either in hull, machinery, armament, complement of men, boats, or stores, or other details shall be permitted without the concurrence of the Board.

7. The Controller shall be responsible that not any deviation from the designs approved by the Board shall take place which would in any way affect the immersion of the ship when completed for service. —(Board Minute, 15th February, 1887.)

REVISED METHOD OF CALCULATING LOAD DRAUGHT OF SHIPS.

The load draught of a ship is to be regarded as the draught at which she will float when laden with her full complement of sea stores, water, provisions, ammunition, coals, &c.

The whole quantity of coals that may be decided to be necessary for all sea-going and fighting requirements, whether carried in the bunkers or in the form of coal protection, is to be included in the full complement at the load draught, and the particulars of a design as described in the ordinary legend form, or in any other manner, are always to be given for the load draught as thus defined.

The full speed of a ship is to be estimated or obtained at measured mile, at the same draught, and the full speed at sea is to be determined by the average speed that can be maintained over a continuous run of four days at sea when the vessel is laden at her load draught at starting.

The legend forms that are used for stating these particulars should be corrected so as to distinctly indicate that they apply to the fully laden condition of a ship.—(Board Minute, 21st September, 1886.)

APPENDIX II.

Defects of Ships in Commission.

Admiralty, S.W., February 5, 1887.

Sir,

Numerous instances having been recently brought to the notice of my Lords in which officers in command of Her Majesty's ships have sent to the dockyards lists of defects to be made good which contained items of work that could and should have been undertaken by artificers of the ships; as well as proposals for alterations of a nature which, while not adding to efficiency, would fritter away money which might be more profitably applied, my Lords direct the attention of Commanding Officers to Article 1220, p. 392 of the Queen's Regulations, and impress upon them the necessity of a cessation of these practices, tending as they do to the performance of unnecessary work in the dockyards, which ought to be devoted to maintaining and strengthening the fighting efficiency of the fleet.

2. Having thus pointedly called attention to the matter, my Lords expect that Commanding Officers will realize the paramount importance of the ships under their command being kept as free from defects and ready for service as the means on board will permit, requisitioning from the dockyard only for such repairs as are undoubtedly beyond their own resources.

3. Attention is also called to the fact of ship's books having been supplied to Captains to inform them of the previous history of their ships, thus enabling them to watch and influence, as far as possible, expenditure on repairs.

4. Any failure or neglect to comply with these directions will not be viewed with indifference by their Lordships, and will influence their decision as to the merits of officers, and their fitness for the command of Her Majesty's ships.

I am, Sir,
Your obedient Servant,
Evan MacGregor.

To the Commander-in-chief
on the Station.

ENGLISH NAVY

Votes.		Estimates, 1887-88.		
		Gross Estimate.	Appropriations in Aid.	Net Estimate.
	I. NUMBERS.			Total Numbers.
A.	Total Number of Officers, Seamen, Boys, Coastguard, and Royal Marines	....	....	62,500
	II.—EFFECTIVE SERVICES.	£	£	£
1	Wages, &c., of Seamen and Marines .	3,063,739	123,039	2,940,700
2	Victuals and Clothing for Seamen and Marines	1,277,850	285,850	992,000
3	Admiralty Office	215,820	4,520	211,300
4	Coastguard Service and Royal Naval Reserves, &c.	204,967	67	204,900
5	Scientific Branch	135,946	27,146	108,800
6	Dockyards and Naval Yards at Home and Abroad	1,733,417	817	1,732,600
7	Victualling Yards at Home and Abroad	71,900	100	71,800
8	Medical Establishments at Home and Abroad	65,930	30	65,900
9	Marine Divisions	21,734	34	21,700
10	Naval Stores for Building and Repairing the Fleet, &c., Machinery and Ships Built by Contract:			
..	Section I.—Naval Stores . .	1,377,000	170,000	1,207,000
..	Section II.—Machinery and Ships built by Contract, &c. . .	1,911,000	....	1,911,000
11	New Works, Buildings, Yard Machinery, and Repairs . . .	560,325	7,025	553,300
12	Medicines and Medical Stores, &c. .	75,400	19,300	56,100
13	Martial Law, &c.	11,500	....	11,500
14	Miscellaneous Services	191,128	5,028	186,100
	£	10,917,656	642,956	10,274,700
	III.—NON-EFFECTIVE SERVICES.			
15	Half-pay, Reserved Half-pay, and Retired Pay to Officers of the Navy and Marines	801,412	12	801,400
16	Military and Civil Pensions and Allowances:			
..	Section I.—Military Pensions and Allowances	906,844	44	906,800
..	Section II.—Civil Pensions and Allowances	329,337	537	328,800
	£	2,037,593	593	2,037,000
	Total for the Naval Service . £	12,955,249	643,549	12,311,700
	IV.—EXTRA ESTIMATE FOR SERVICES NOT NAVAL.			
17	Freight, &c., for the Army (Conveyance of Troops)	207,000	41,900	165,100
	Balances written off as Irrecoverable in 1885-6	....	....	....
	GRAND TOTAL . . £	13,162,249	685,449	12,476,800

ESTIMATES.

Estimates, 1886–87, Including Supplementary Estimate.			Difference on Net Estimates.		Actual Ordinary Expenditure, 1885–86, including Supplementary Estimates, but exclusive of "Egypt."	Votes.
Gross Estimate.	Appropriations in Aid.	Net Estimate.	Increase.	Decrease.		
		Total Numbers.	Numbers.	Numbers.		
....	....	61,400	1,100	....	....	A.
£	£	£	£	£	£	
3,021,635	118,735	2,902,900	37,800	....	2,773,634	1
1,246,800	282,400	964,400	27,600	....	939,894	2
211,420	4,520	206,900	4,400	....	200,216	3
207,667	67	207,600	....	2,700	192,554	4
134,638	21,438	113,200	....	4,400	109,538	5
1,730,317	817	1,729,500	3,100	....	1,670,432	6
70,760	60	70,700	1,100	....	71,248	7
67,060	60	67,000	....	1,100	68,380	8
21,734	34	21,700	....	....	20,797	9
						10
1,421,000	136,000	1,285,000	....	78,000	1,344,250	Sec. I.
2,476,300	....	2,476,300	....	565,300	2,127,756	Sec. II.
630,653	6,953	623,700	....	70,400	637,373	11
87,060	18,960	68,100	....	12,000	67,649	12
9,400	....	9,400	2,100	....	8,954	13
148,260	5,060	143,200	42,900	....	145,142	14
11,484,704	595,104	10,889,600	119,000	733,900	10,377,817	
812,950	50	812,900	....	11,500	817,190	
905,871	71	905,800	1,000	....	892,920	Sec. I.
333,801	501	333,300	....	4,500	330,661	Sec. II.
2,052,622	622	2,052,000	1,000	16,000	2,040,771	
13,537,326	595,726	12,941,600	120,000	749,900	12,418,588	
374,200	45,700	328,500	....	163,400	269,850	17
....	....	....	....	...	1,168	
13,911,526	641,426	13,270,100	120,000	913,300	12,689,606	
			Net Decrease, £793,300			

STATEMENT of the Principal Points of Difference between the Estimates of 1886–87 (inclusive of Supplementary Estimate) and those for 1887–88.

INCREASES.		£
Wages and Allowances of Seamen and Marines		37,800
Victuals and Clothing for Seamen and Marines		27,600
Experimental Services		23,000
Armour-Piercing Projectiles, &c.		24,100
Royal Reserve of Merchant Cruisers		13,000
Admiralty Contribution on completion of Dry Dock at Esquimalt		50,000
		£175,500
DECREASES.	£	
Increase in anticipated Receipts from Sales of Ships	35,000	
Naval Stores	43,000	
Machinery for propelling Her Majesty's Ships	143,700	
Ships Building by Contract	440,100	
Purchase of Torpedoes	6,900	
Gun Mountings, Torpedo Carriages, &c.	23,400	
New Works, Buildings, Repairs, and Yard Machinery	70,400	
Non-Effective Services	15,000	
Transport Services	163,400	
Miscellaneous Services (Net)	27,900	
		968,800
Net Decrease	. . .	£793,300

Note.—The Expenditure in 1887–88, consequent on Leap Year, and wages for 53 weeks coming in course of payment in that year, is estimated at £32,633.

NUMBERS OF OFFICERS AND MEN OF THE NAVY, ROYAL MARINES, ROYAL NAVAL RESERVE, SEAMEN AND MARINE PENSIONERS RESERVE, AND ROYAL NAVAL ARTILLERY VOLUNTEERS.

		Numbers borne Dec. 1886.
FLEET SERVICE:		
Officers and Seamen		37,467
Boys		6,877
COASTGUARD		3,914
ROYAL MARINES		12,697
NAVAL ESTABLISHMENTS ON SHORE:		
Officers, Seamen, &c.		575
Royal Marines		193
Officers on Half-pay		342
ROYAL NAVAL RESERVE:		
Officers	264	
Men	18,007	18,271
SEAMEN AND MARINE PENSIONERS RESERVE		2,197
ROYAL NAVAL ARTILLERY VOLUNTEERS:		
Officers	65	
Men	1,477	1,542
Total		84,075*

Officers on the Reserved Half-Pay List	56
Officers on the Retired List	2,025
	2,081

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* *Note.*—In addition to this number all Pensioners whose age shall not exceed 55 years, are liable to be called up for active service in case of war or any emergency. The number available may be taken as about 10,000.

NUMBER OF OFFICERS, SEAMEN, BOYS, COASTGUARD, AND ROYAL MARINES, FOR WHOM PROVISION IS MADE IN THE NAVY ESTIMATES, 1887–88.

Sixty-two Thousand Five Hundred.

	Flag Officers.	Commissioned Officers.	Subordinate Officers.	Warrant Officers.	Chief Officers.	Petty Officers, Seamen, &c.	Boys.	Numbers, all Ranks. 1887–88.		Numbers, all Ranks. 1886–1887.	
For Her Majesty's Fleet.											
(Including Indian Troop Ships).											
Officers and Seamen	13	2,153	268	663	..	25,954	..	29,051		28,494	
Reserves and under Training	..	544	259	214	..	8,047	..	9,064		8,307	
Pensioners	..	..	..	..	..	651	..	651		650	
Estimate, 1887–88	13	2,697	527	877	..	34,652	..	..	38,766		
Estimate, 1886–87	13	2,686	495	882	..	33,375	..	..	..	..	37,451
Boys.											
For service in the Fleet	..	..	..	..	..	..	4,224	4,224		3,874	
Under instruction in Training Ships	..	..	..	..	..	..	1,950	1,950	6,174	2,600	6,474
Coastguard.											
Officers and Men:											
Estimate, 1887–88	..	94	..	1	226	3,679	..	4,000	4,000	4,000	
Estimate, 1886–1887	..	96	..	1	224	3,679	..	..	..		4,000
									48,940		47,925

Royal Marines.	Commissioned Officers.	Warrant Officers.	Staff Serjeants and Serjeants.	Buglers and Musicians.	Rank and File.	Numbers, all Ranks. 1887–88.		Numbers, all Ranks. 1886–1887.	
Head Quarters Staff	5	2	4	..	..	11		11	
Service Afloat	81	..	240	121	6,391	6,833		6,434	
Service on Shore	254	36	575	242	4,758	5,865		6,262	
Estimate, 1887–88	340	38	819	363	11,149	..	12,709		
Estimate, 1886–87	340	38	816	363	11,150	..	..	..	12,707
Numbers provided for in Vote 1	..	..	..	..	..	..	61,649	..	60,632

In Naval Establishments on Shore.	Flag Officers.	Commissioned Officers.	Warrant Officers.	Petty Officers, Seamen, &c.	Boys.				
Officers and Seamen borne on Ships' Books:									
Officers Superintending Her Majesty's Dockyards, &c., and their Retinues	4	6	..	20	..	30		30	
Officers and Seamen	1	108	24	471	26	630		545	
Estimate, 1887–88	5	114	24	491	26	..	660		
Estimate, 1886–87	5	109	22	413	26	..	..	...	575
Royal Marines borne on Ships' Books, or at Divisional Head Quarters:	Commissioned Officers.	Serjeants.	Bugler.	Rank and File.					
Estimate, 1887–88	27	10	1	153		191	191	193	
Estimate, 1886–87	27	17	1	148		..	..		193
Numbers provided for in other Votes	..	..	..	..			851	..	768
Total Numbers						..	62,500	..	61,400

Net Increase 1,100

SERVICES upon which the NUMBERS taken in Vote (A.) are Employed.

	NAVAL OFFICERS, SEAMEN, AND BOYS.							ROYAL MARINES.					NUMBERS, ALL RANKS.	
	Flag Officers.	Commissioned Officers.	Subordinate Officers.	Warrant Officers.	Chief Officers.	Petty Officers, Seamen, &c.	Boys.	Commissioned Officers.	Warrant Officers.	Staff Serjeants and Serjeants.	Buglers and Musicians.	Rank and File.	1887–88.	1886–87.
SERVICE AFLOAT:														
Effective for General Service	9	1,305	250	314	..	16,904	3,899	47	..	154	77	3,987	26,946	26,013
First Reserve Ships and Tenders	..	188	14	55	..	2,122	175	14	..	24	10	720	3,322	3,270
Gunnery and Training Ships	..	135	..	117	..	1,769	60	2	..	17	17	441	2,558	2,509
Stationary Ships	4	272	..	105	..	2,689	31	18	..	35	17	1,001	4,172	3,909
Surveying Ships	..	76	..	5	..	505	28	..	..	..	..	48	662	663
Troop Ships { Imperial Service	..	81	..	28	..	819	18	..	..	6	..	109	1,061	1,050
Troop Ships { Indian Service	..	64	4	28	..	864	4	..	..	4	..	76	1,044	1,044
Store Ships	..	6	..	2	..	59	..	..	..	..	..	9	76	76
Drill Ships	..	26	..	9	..	223	9	..	..	..	..	..	267	268
In Reserves and under Training	..	544	259	214	..	8,047	1,950	..	..	..	..	..	11,014	10,907
Pensioners	..	..	..	..	..	651	..	..	..	..	..	..	651	650
SERVICE ON SHORE:														
Coast Guard on Shore	..	94	..	1	226	3,679	..	..	..	..	..	..	4,000	4,000
Royal Marines:														
Head Quarters Staff	..	..	..	..	..	..	..	5	2	4	..	..	11	11
Marines on Shore	..	..	..	..	..	..	..	254	36	575	242	4,758	5,865	6,262
Numbers provided for in Vote 1	13	2,791	527	878	226	38,331	6,174	340	38	819	363	11,149	61,649	60,632
	48,940.							12,709.						

NAVAL ESTABLISHMENTS ON SHORE:*														
Votes in which provided;														
Vote 3.—Admiralty Office . .	..	9	..	1	..	..	..	..	..	..	..	..	10†	7
„ 4.—Coast Guard Service, &c.	1	3	..	..	..	..	..	..	..	..	..	..	4	4
„ 5.—Scientific Branch . .	..	43	..	3	..	71	..	2	..	3	..	10	132	132
„ 6.—Dockyards and Naval Yards at Home and Abroad	4	45	..	19	..	210	1	..	..	..	..	1	280	252
„ 7.—Victualling Yards at Home and Abroad .	..	2	..	1	..	4	..	..	..	..	..	2	9	9
„ 8.—Medical Establishments at Home and Abroad	..	4	..	..	..	158	25	11	..	..	..	3	201	153
„ 9.—Marine Divisions . .	..	..	..	..	..	..	..	10	..	..	..	..	10	10
„ 10.—Naval Stores for Building and Repairing the Fleet, &c. .	..	8	..	..	..	..	..	..	..	..	..	..	8	7
„ 11.—New Works, Buildings, Yard Machinery, &c. . .	..	..	..	..	..	28	..	4	..	6	1	134	173	171
„ 13.—Martial Law, &c. . .	..	..	..	..	..	17	..	..	..	1	..	3	21	20
„ 14.—Miscellaneous Services	..	..	..	..	..	3	..	..	..	..	..	..	3	3
Numbers provided for in other Votes . .	5	114	..	24	..	491	26	27	..	10	1	153	851	768
	660.							191.						
												Total . . .	62,500	61,400

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* Borne on Ships' Book, or at Divisional Headquarters.

† These numbers do not include the additional Staff required for the Naval Intelligence Department for which provision is made in Vote 3.

NUMBER of SHIPS and VESSELS estimated to be in COMMISSION in 1887–8, compared with the Number in COMMISSION in 1886–7.

CLASS OF SHIPS.	IN COMMISSION.		NUMBER More or Less on 1st November, 1886.	
	On 1st November, 1886.	On 1st November, 1885.	More.	Less.
STEAM SHIPS.				
Armour-plated Ships	29	30	..	1
Frigates	1	1		
Corvettes	31	26	5	
Torpedo Ram	1	1		
Sloops	18	16	2	
Gun Vessels	17	22	..	5
Gunboats	46	48	..	2
Miscellaneous Vessels	26	25	1	
Despatch Vessels	2	2		
Troop Ships and Troop Store Ships	7	7		
Indian Troop Ships	4	4		
Royal Yachts	4	4		
Surveying Vessels	7	5	2	
	193	191	10	8
SAILING VESSELS.				
Sloop	1	1		
Schooners	4	4		
Training Brigs	6	6		
Miscellaneous Vessels				
Coast Guard Tenders (late Revenue Cruisers)	19	19		
	30	30		
STATIONARY SHIPS.				
Flag, Receiving, Steam Reserve, and Store Ships	15	15		
Training and Drill Ships	22	22		
	37	37		
	260	258	10	8

More in 1887–8 . . . . . . 2.

In addition to the Ships and Vessels in Commission above specified, there will be a larger number of Torpedo Boats in the Navy in 1887–88 than in 1886–87, requiring suitable complements.

LIST of NEW SHIPS and VESSELS Estimated to be passed into the FIRST RESERVE during the Years 1887–88 and 1886–87.

1887–88.

Name of Ship.		Load Displacement in Tons.	Indicated Horse Power.	Number of Guns.
ARMOURED SHIPS:				
Benbow	Armour-plated Barbette Ships.	10,000	11,500	12
Howe		9,700	11,500	10
Rodney		9,700	11,500	10
Hero	Armour-plated Turret Ship.	6,200	6,000	6
Warspite	Armour-plated Barbette Cruiser.	8,500	10,000	10
Australia	Armour-plated Cruisers.	5,000	8,500	12
Galatea		5,000	8,500	12
Narcissus		5,000	8,500	12
Orlando		5,000	8,500	12
Undaunted		5,000	8,500	12
PROTECTED SHIPS:				
Severn	Second Class Cruisers.	3,550	6,000	12
Thames		3,550	5,700	12
UNPROTECTED SHIPS:				
Racoon	Torpedo Cruisers.	1,630	4,500	6
Serpent		1,630	4,500	6
Archer		1,630	3,500	6
Brisk		1,630	3,500	6
Cossack		1,630	3,500	6
Fearless		1,430	3,200	4
Porpoise		1,630	3,500	6
Tartar		1,630	3,500	6
Buzzard	Composite Sloop.	1,140	2,000	8
Grasshopper	Torpedo Gun-boats.	450	3,000	1
Sandfly		450	3,000	1
Spider		450	3,000	1
Bramble	Composite Gunboats.	715	1,000	6
Lizard		715	1,000	6

1886–87.

Name of Ship.		Load Displacement in Tons.	Indicated Horse Power.	Number of Guns.
ARMOURED SHIPS:				
Collingwood	Armour-plated Barbette Ship.	9,150	9,570	10
Edinburgh	Armour-plated Turret Ship.	9,150	7,500	9
Impérieuse	Armour-plated Barbette Cruiser.	8,500	10,000	10
PROTECTED SHIP:				
Mersey	Second Class Cruiser.	3,550	6,000	12
PARTIALLY PROTECTED SHIPS:				
Arethusa	Second Class Cruisers.	3,750	5,500	10
Phaeton		3,750	5,500	10
Amphion		3,750	5,500	10
UNPROTECTED SHIPS:				
Mohawk	Torpedo Cruisers.	1,630	3,500	6
Scout		1,430	3,200	4
Alacrity	Despatch Vessels.	1,400	3,180	6
Surprise		1,400	3,030	6
Acorn	Composite Gun Vessels.	970	1,380	8
Swallow		1,130	1,570	8
Icarus		970	1,230	8
Curlew	Gun and Torpedo Vessels.	955	1,500	4
Landrail		955	1,500	4
Rattlesnake	Torpedo Gunboat.	450	2,700	1
Rattler	Composite Gunboats.	715	1,200	6
Wasp		715	1,000	6
Jackal (late Woodcock)		750	814	..
Hearty		1,300	1,800	4

SHIPS BUILDING OR COMPLETING in HER MAJESTY'S DOCKYARDS for which MONEY has been taken in NAVY ESTIMATES, 1887–88.

Name of Ship.	Description.	Total Estimated Cost, including Armament.	Displacement at Draught Load.	Speed. Knots.	Maker of Machinery.	Date. Laid Down.	Date. For Completion.	Armament, excluding Machine Guns and Torpedoes.	Where Building.
ARMOURED SHIPS:		£							
Trafalgar . .	Steel Armour-plated Turret Ship.	884,318	11,940	16·5	Humphrys, Tennant & Co.	Jan. 1886	1891	4 67-ton, 8 5-inch . 18 quick-firing .	Portsmouth.
Anson . .	Steel Armour-plated Barbette Ship.	752,288	10,000	17	Ditto.	April 1883	1888	4 67-ton, 6 6-inch, 19 quick-firing.	Ditto.
Camperdown .	Ditto ditto.	743,074	10,000	17	Maudslay, Sons and Field	Dec. 1882	March 1888	Ditto ditto.	Ditto.
Howe . .	Ditto ditto.	729,771	9,700	17	Humphrys, Tennant & Co.	June 1882	Dec. 1887	Ditto ditto.	Ditto.
Collingwood .	Ditto ditto.	670,752	9,150	16·5	Ditto.	July 1880	complete extra-Armament.	4 44-ton, 6 6-inch, 12 quick-firing.	Ditto.
Edinburgh . .	Steel Armour-plated Turret Ship.	683,609	9,150	15·4	Ditto.	March 1879	completed.	4 45-ton, 5 6-inch, 4 quick-firing.	Ditto.
Impérieuse . .	Steel Armour-plated Barbette Ship.	559,901	8,500	17	Maudslay, Sons and Field.	Aug. 1881	complete.	4 9·2-inch, 6 6-inch, 4 quick-firing.	Ditto.
Warspite . .	Ditto ditto.	558,449	8,500	17	J. Penn and Sons.	Oct. 1881	1887–8	4 22-ton, 6 6-inch, 4 quick-firing.	Completing. Chatham.
Nile . . .	Steel Armour-plated Turret Ship.	889,421	11,940	16·5	Maudslay, Sons and Field.	April 1886	1891	4 67-ton, 8 5-inch, 18 quick-firing.	Pembroke.
Aurora . .	Steel Armour-plated Cruiser	308,585	5,000	18	J. and G. Thomson.	Feb. 1886	1889–90	2 22-ton, 10 6-inch, 16 quick-firing.	Ditto.
Rodney . .	Steel Armour-plated Barbette Ship.	726,482	9,700	17	Humphrys, Tennant & Co.	Feb. 1882	August 1887	4 63-ton, 6 6-inch, 14 quick-firing.	Chatham.
Hero . . .	Steel Armour-plated Turret Ship.	421,500	6,200	15·5	J. and G. Rennie.	April 1884	Nov. 1887	2 45-ton, 4 6-inch, 12 quick-firing.	Ditto.
Immortalité .	Steel Armour-plated Cruiser	302,920	5,000	18	Earles' Shipbuilding Co.	Jan. 1886	1888–9	2 22-ton, 10 6-inch, 16 quick-firing.	Ditto.

PROTECTED SHIPS:									
Mersey	Steel-protected Cruiser	236,437	3,550	18	Humphrys, Tennant & Co.	July 1883	complete.	2 8-inch, 10 6-inch, 3 quick-firing.	Ditto.
Severn	Ditto ditto.	234,282	3,550	18	Humphrys, Tennant & Co.	Jan. 1884		Ditto ditto.	Chatham.
Thames	Ditto ditto.	227,980	3,550	18	J. Penn and Sons.	April 1884	March 1888	Ditto ditto.	Devonport, completing.
Forth	Ditto ditto.	221,913	3,550	18	R. and W. Hawthorn.	Dec. 1884	1888–9	Ditto ditto.	Pembroke.
UNPROTECTED SHIPS:									
Amphion	Steel Cruiser	202,641	3,750	16·5	Maudslay, Sons and Field.	April 1881	complete.	10 6-inch	Ditto.
Medea	Ditto.	..	2,800	20	Humphrys&Co.	1887–88	1889	6 6-inch, 9 quick-firing	Chatham.
Medusa	Ditto.	..	2,800	20	Ditto.	1887–88	1889	Ditto ditto.	Ditto.
Melpomene	Ditto.	..	2,950	..	Palmer	1887–88	..	.. ..	Portsmouth.
Serpent	Steel Torpedo Cruiser	101,657	1,630	17·5	Harland&Wolff	Nov. 1885	March 1888	6 6-inch, 8 quick-firing	Devonport.
Racoon	Ditto ditto.	101,607	1,630	17·5	Ditto.	Feb. 1886	March 1888	Ditto ditto.	Ditto.
Curlew	Steel gun & Torpedo vessel	60,341	955	15	J. Penn and Sons.	Jan. 1885	complete.	1 6-inch, 3 5-inch	Ditto.
Landrail	Ditto ditto.	60,143	955	15	Ditto.	Jan. 1885	Sept. 1886, complete.	Ditto ditto.	Ditto.
Grasshopper	Steel Torpedo Gunboat	35,968	450	19	Maudslay, Sons and Field.	April 1886	1887–8	1 4-inch, 6 quick-firing	Sheerness.
Sandfly	Ditto ditto.	38,100	450	19	Ditto.	April 1886	1887–8	Ditto ditto.	Devonport.
Spider	Ditto ditto.	38,227	450	19	Ditto.	June 1886	Dec. 1888	Ditto ditto.	Ditto.
Sharpshooter	Gunboat	..	..	..	..	..	..	.. ..	Ditto.
Swallow	Composite Sloop	68,186	1,130	13·5	J. and G. Rennie.	Jan. 1885	complete Nov. 1886	8 5-inch	Sheerness.
Buzzard	Ditto.	68,219	1,140	14·5	Barrow Co.	May 1886	1887–8	Ditto.	Ditto.
Daphne	Ditto.	..	1,135	14·5	..	1887–8	1888–9	Ditto.	Ditto.
Nymphe	Ditto.	..	1,140	14·5	Greenock	1887–8	1888	Ditto.	Portsmouth.
Icarus	Ditto.	58,363	970	12·5	Barrow Co.	Aug. 1884	complete May 1886	Ditto.	Devonport.
*6 Rattlers	Composite Gunboats	..	755	13·5	..	..	..	6 4-inch	..
Melita	Composite Sloop	55,689	970	12·5	Malta Yard	July 1883	1888–9	8 5-inch	Malta.
	Mooring Lighter	6,400	..	..	..	Oct. 1884	1887–8	.. ..	Ditto.

* Pheasant, Partridge, Peacock, Pigeon, Plover, Pigmy.

SHIPS BUILDING by CONTRACT in which MONEY has been taken in NAVY ESTIMATES, 1887–88.

Name of Ship.	Description.	Total estimated Cost, including Armament.	Displacement at Load Draft.	Speed. Knots.	Maker of Machinery.	Date.		Armament, excluding Machine Guns and Torpedoes.	Where Building.
						Laid down.	For completion by Contractors.		
ARMOURED SHIPS:		£							
Victoria . .	Steel Armour-plated Turret Ship . .	829,979	11,470	16·75	Humphrys, Tennant & Co.	April 1885	October 1888, by Contractors. .	2 110-ton, 1 10-inch, 12 6-inch, and 21 quick-firing . .	Sir W. G. Armstrong, Mitchell & Co.
Sans Pareil. .	Ditto.	825,468	11,470	16·75	Ditto.	April 1885	Ditto.	Ditto.	Thames Iron Works.
Benbow. . .	Steel Armour-plated Barbette Ship .	810,633	10,000	17	Maudslay, Sons and Field .	Nov. 1882	March 1888, by Dockyard . .	2 110-ton, 10 6-inch, 15 quick-firing .	Ditto, completing Chatham
Australia . .	Steel Armour-plated Cruiser . . .	296,613	5,000	18	Messrs. Napier	April 1885	Ditto.	2 9·2 inch, 10 6-inch, 16 quick-firing .	Messrs. Napier Sons.
Galatea . . .	Ditto.	290,300	5,000	18	Ditto.	April 1885	Ditto.	Ditto.	Ditto.
Narcissus . .	Ditto.	290,751	5,000	18	Earles' Shipbuilding Co.	April 1885	Ditto.	Ditto.	Earles' Shipbuilding Co.
Orlando. . .	Ditto.	299,905	5,000	18	Palmer Shipbuilding Co.	April 1885	Ditto.	Ditto.	Palmer Shipbuilding Co.
Undaunted. .	Ditto.	299,525	5,000	18	Ditto.	April 1885	Ditto.	Ditto.	Ditto.
UNPROTECTED SHIPS:									
Arethusa . .	Steel Cruiser . .	189,340	3,750	16·5	Napier & Sons	June 1880	Complete . . .	10 6-inch . . .	Napier
Phaeton . .	Ditto.	190,296	3,750	16·5	Ditto.	June 1880	Complete . . .	Ditto.	Ditto.
Archer . . .	Steel Torpedo Cruiser . . .	97,449	1,630	17	J. & G. Thomson . . .	March 1885	1887–88, by Dockyard. . . .	6 6-inch, 8 quick-firing	Thomson
Brisk . . .	Ditto.	97,925	1,630	17	Ditto.	March 1885	Ditto.	Ditto.	Ditto.
Cossack . . .	Ditto.	97,265	1,630	17	Ditto.	March 1885	Ditto.	Ditto.	Ditto.
Mohawk . .	Ditto.	97,731	1,630	17	Ditto.	March 1885	Ditto.	Ditto.	Ditto.
Porpoise . . .	Ditto.	98,182	1,630	17	Ditto.	March 1885	Ditto.	Ditto.	Ditto.
Tartar . . .	Ditto.	96,480	1,630	17	Ditto.	March 1885	Ditto.	Ditto.	Ditto.

Scout	Ditto.	97,167	1,600	16·75	Ditto.	Jan. 1884	Completed Nov. 1886, Portsmouth	4 5-inch, 8 quick-firing	Ditto.
Fearless	Ditto.	92,103	1,600	16·75	Barrow Co.	Sept. 1884	1887–88, by Dockyard.	Ditto.	Barrow Co.
Surprise	Steel Despatch Vessel	85,457	1,400	17	Palmer Shipbuilding Co.	Feb. 1884	Complete	4 5-inch, 4 quick-firing	Palmer
Alacrity	Ditto.	85,518	1,400	17	Ditto.	Feb. 1884	Complete	Ditto.	Ditto.
Bramble	Composite Gunboat	51,831	715	13	Harland and Wolff	Aug. 1885	1887–88	6 4-inch	Harland and Wolff
Lizard	Ditto.	53,131	715	13	Ditto.	Aug. 1885	1887–88	Ditto.	Ditto.
Rattler	Ditto.	41,343	715	13·75	R. & W. Hawthorn	Aug. 1885	Complete	Ditto.	Sir W. and G. Armstrong
Wasp	Ditto.	38,511	715	13	North-Eastern Engineering Co.	Aug. 1885	Complete	Ditto.	Ditto.
Rattlesnake	Steel Torpedo Gunboat	37,328	450	19	Laird Brothers	Nov. 1885	April 1887	1 4-inch, 6 quick-firing	Laird Brothers
Acorn	Composite Sloop	61,654	970	12·5	Maudslay, Sons and Field	Oct. 1882	Complete	8 5-inch	Milford Haven Co.
Hearty	Iron Tug	42,182	1,300	..	Thomson, Dundee	Aug. 1886	Complete	2 4-inch, 2 12-pounder	Thomson, Dundee
Jackal	Iron Coasting Vessel	26,691	750	12·8	Redhead & Co.	purchased 1885	Completed, Devonport, 1886	2 4-inch, 2 12-pounder	Redhead & Co.
Bann	Steel Tank Vessel.	8,536	250	..	Queenstown and Passage Dock Co.	Jan. 1885	Completed, Devonport, Oct. 1886.	..	Queenstown & Passage Docks
Magicienne	Fast Cruisers	..	2,950	..	Hawthorn	..	Dec. 1888.	..	Fairfield.
Marathon	..	..	2,950	..		..	Ditto.	..	Ditto.
			Tons.	Knots.	TORPEDO BOATS.				
	54 Torpedo Boats	.. 822,941	70·90	18–19	..	..	..	2 machine guns, and 4 or 5 torpedoes	Yarrow, Thornycroft & White
	1 Ditto	..	105	22	..	..	..	3 quick-firing guns, and 3 torpedoes	Yarrow

ABSTRACT of SHIPS BUILDING or COMPLETING for which MONEY has been taken in NAVY ESTIMATES, 1887–88.

	Dockyards.	Contract.	Total.
Armoured Ships	13	8	21
Protected Ships	4	..	4
Unprotected Ships	25	23	48
Torpedo Boats	..	55	55
	42	86	128

SUMMARY showing the APPROPRIATION of LABOUR and MATERALS on

—	ESTIMATED EXPENDITURE					
	DOCKYARD WORK.			CONTRACT		
	Vote 6. Labour.		Vote 10. Section I.	Vote 10,		
	Dockyards at Home.	Dockyards Abroad.	Materials.	Propelling Machinery.	Hulls, &c., Building by Contract.	Steam Launches, &c..
	£	£	£	£	£	£
Ships Building in Her Majesty's Dockyards (including Malta)	569,940	10,000	679,085	363,404	..	..
Ships Building by Contract .	132,191	..	82,336	204,546	578,600	10,000
TOTAL New Construction .	**702,131**	**10,000**	**761,421**	**567,950**	**578,600**	**10,000**
Ships Refitting for Reliefs Home Yards	189,268	..	90,802	..	..	..
Ships Preparing for Re-Commission . Foreign Yards	..	35,313	26,980	..	..	..
Repairs to Ships in Commission and in Reserve:						
Ships of Channel Squadron. . . . . . Coast Guard Ships (First Reserve) and Tenders . . . . Ships in Steam Reserve — Home Yards	133,000	..	89,690	..	..	..
Harbour, Gunnery, and Training Ships . . Tugs and Yard Craft Yachts . . . . . Contingent Work . . — Foreign Yards	..	36,732	20,000	..	..	..
TOTAL Refitting, &c. .	322,268	72,045	236,472	..	..	..

ESTIMATED TOTAL EXPENDITURE on NEW

CLASS OF SHIP.	1887–88.			
	No.	Ordinary.	Additional.	TOTAL.
		£	£	£
Armoured Ships	16	538,223	891,418	2,072,059
Ditto . "Nile" and "Trafalgar"	2	642,418		
Protected Ships	8	393,702	..	393,702
Partially Protected Ships . .	..	..	..	..
Unprotected Ships . . .	25	*420,762	100,618	521,380
Torpedo Boats, 1st Class . .	20	26,022	..	26,022
Ditto . 2nd „	4	7,092	..	7,092
Steam Launches, &c.	..	24,000	..	24,000
Superintendence of Contract Work .	..	8,700	5,300	14,000
TOTAL . .	**75**	**2,060,919**	**997,336**	**3,058,255**

* Includes completion of a new Mooring Lighter at Malta.

Liabilities for future years, under Naval Votes, on

SHIPBUILDING, REPAIRS and MAINTENANCE, and MISCELLANEOUS SERVICES.

DURING 1887-88. WORK, &c. Section II. Auxiliary Machinery.	Repairs, &c., by Contract.	Superintendence of Contract Work.	Gun Mountings and Torpedo Gear.	TOTAL. VOTE 10. Section II.	GRAND TOTAL. VOTE 6, and VOTE 10. Sections I. and II.	Liabilities for Future Years. — Naval Votes.	Estimated Expenditure for Guns, &c., Chargeable to Army Votes.
£	£	£	£	£	£	£	£
14,120	..	14,000	180,216	557,740	1,816,765	1,089,967	640,172
4,000	..		215,817	1,026,963	1,241,490	423,385	404,180
18,120	..	**14,000**	**396,033**	**1,584,703**	**3,058,255**	**1,513,352**	**1,044,352**
..	..	..	9,146	9,146	298,216	61,574	16,720
..	..	..	1,000	1,000	63,293	1,814	1,128
..	30,000	..	..	30,000	309,422	..	..
..							
..	30,000	..	10,146	40,146	670,931	63,388	17,848

CONSTRUCTION in 1887–88 as compared with 1886–87.

1886-87. (PROBABLE ACTUAL.) No.	Ordinary.	Additional.	TOTAL.	CLASS OF SHIP.
	£	£	£	
15	944,019	1,063,166	2,394,371	Armoured Ships.
2	387,186			Ditto . "Nile" and "Trafalgar."
4	168,668	..	168,668	Protected Ships.
3	5,015	..	5,015	Partially Protected Ships.
25	415,456	153,404	568,860	Unprotected Ships.
35	201,715	95,462	297,177	Torpedo Boats, 1st Class.
..	..	..	..	Ditto . 2nd ,,
..	12,298	..	12,298	Steam Launches, &c.
..	10,000	7,500	17,500	Superintendence of Contract Work.
84	**2,144,357**	**1,319,532**	**3,463,889**	. . **TOTAL.**

account of New Construction . . £1,513,352.

STATEMENT of the Number and Description of WORKMEN at the several DOCKYARDS at HOME.

	Number.
Blockmills	17
Blockmakers	7
Boilermakers	147
Braziers and Tinmen	12
Bricklayers	5
Caulkers	190
Coppersmiths	56
Engine-keepers	7
Fitters	330
Founders	37
Hosemakers	8
Joiners	508
Labourers	726
Locksmiths	7
Masons	5
Messengers	18
Oar Machine	6
Packing-case Maker	1
Painters, Glaziers, &c.	94
Pattern Makers	21
Plumbers	43
Riggers	335
Ropemakers	43
Sailmakers	93
Sawyers	52
Sawmills	89
Shipwrights	2,695
Smiths	821
Storehousemen	170
Spinning Machinery	10
Surgery Attendants	9
Wheelwrights	17
Established Men	6,579
Hired Men of all Classes	12,525
TOTAL	19,104

A LIST OF THE ARMOURED AND UNARMOURED FIGHTING SHIPS OF ENGLAND LAID DOWN TO BUILD SINCE APRIL, 1880.

Rate.	Name.	When Laid Down.
	1880.	
Armour-plated Steel Barbette Ship	Collingwood.	12 July
Steam Cruiser	Leander	14 June
„ „	Phaeton	14 June
„ „	Arethusa	14 June
Composite Sloop	Satellite *	4 Oct.
„ „	Heroine *	30 Aug.
„ „	Hyacinth *	30 Aug.
Composite Gunboat	Starling	19 Aug.
„ „	Stork	19 Aug.
„ „	Raven	19 Aug.
	1881.	
Armour-plated Steel Barbette Ship	Impérieuse	10 Aug.
Armour-plated Steel Barbette Ship	Warspite	25 Oct.
Steam Cruiser	Amphion	25 April
Corvette (Steel and Iron)	Calliope	1 Oct.
Corvette (Steel and Iron)	Calypso	1 Sept.
Composite Sloop	Rapid *	21 April
„ „	Royalist *	27 April
„ „	Caroline *	24 Oct.
Composite Gunboat	Albacore	2 Sept.
„ „	Mistletoe	2 Sept.
„ „	Watchful	2 Sept.
Composite Gun Vessel	Dolphin †	10 Oct.
Composite Gun Vessel	Wanderer †	10 Oct.
Composite Steam Vessel	Alecto	16 Jan.
Composite Steam Vessel	Sphinx	26 Aug.
	1882.	
Armour-plated Steel Barbette Ship	Camperdown	18 Dec.
Armour-plated Steel Barbette Ship	Benbow	1 Nov.
Armour-plated Steel Barbette Ship	Howe	7 June
Armour-plated Steel Barbette Ship	Rodney	6 Feb.
Composite Gun Vessel	Acorn	16 Oct.
	1883.	
Armour-plated Steel Barbette Ship	Anson	24 April
Steam Cruiser (Steel)	Mersey	9 July
Composite Sloop	Pylades *	1 Jan.
Composite Gun Vessel	Mariner	8 Jan.
Composite Gun Vessel	Reindeer	15 Jan.
Composite Gun Vessel	Racer	9 April
Composite Gun Vessel	Melita	18 July
	1884.	
Armour-plated Steel Turret Ship and Ram	Hero	21 April
Steam Cruiser (Steel)	Severn	1 Jan.
„ „	Thames	14 April
„ „	Forth	1 Dec.
	1885.	
Torpedo Cruiser (Steel)	Scout	8 Jan.
Armed Despatch Vessel	Alacrity ‡	14 Feb.
Armed Despatch Vessel	Surprise ‡	14 Feb.

* Re-classified as a Corvette by A. O., 28 July, 1883.

† Re-classified as a Sloop by A. O., 27 May, 1884.

‡ Alacrity and Surprise were not intended to be fighting ships when first laid down, but armaments were ordered for them in January, 1886.

A LIST OF THE ARMOURED AND UNARMOURED FIGHTING SHIPS OF ENGLAND LAID DOWN TO BUILD SINCE APRIL, 1880—*continued.*

Rate.	Name.	When Laid Down.
	1885—*continued.*	
Armed Despatch Vessel . .	Fearless .	22 Sept.
Composite Gun Vessel . .	Icarus . .	18 Aug.
Composite Gun Vessel . .	Swallow .	1 Jan.
Gun and Torpedo Vessel (Steel) .	Curlew .	5 Jan.
Gun and Torpedo Vessel (Steel) .	Landrail .	5 Jan.
Armoured Turret Ship . . .	Renown .	23 April
Armoured Turret Ship . . .	Sans Pareil .	21 April
Torpedo Cruiser .	Archer .	2 March
„ „	Brisk . .	2 March
„ „	Cossack .	2 March
„ „	Mohawk .	2 March
„ „	Porpoise .	2 March
„ „	Serpent .	9 Nov.
„ „	Tartar . .	2 March
Armour - Belted Cruiser . .	Australia .	21 April
Armour - Belted Cruiser . .	Galatea .	21 April
Armour - Belted Cruiser . .	Narcissus .	27 April
Armour - Belted Cruiser . .	Orlando .	23 April
Armour - Belted Cruiser . .	Undaunted .	23 April
Composite Gunboat	Bramble .	25 Aug.
„ „	Lizard. .	25 Aug.
„ „	Rattler .	17 Aug.
„ „	Wasp . .	17 Aug.
Torpedo Gunboat .	Rattlesnake .	— Nov.
	1886.	
Torpedo Cruiser .	Racoon .	1 Feb.
Armour-Belted Cruiser . .	Immortalité .	18 Jan.
Armour-Belted Cruiser . .	Aurora .	1 Feb.
Ironclad Turret .	Trafalgar .	18 Jan.
„ „	Nile . .	8 April
Torpedo Gunboat .	Sandfly .	19 April
„ „	Grasshopper.	27 April
„ „	Spider . .	7 June
Composite Sloop .	Buzzard .	1 May
	1887.	
Cruiser, 2nd class .	Medea .	
„ „ .	Medusa .	
„ „ .	Magicienne .	
„ „ .	Marathon .	
„ „ .	Melpomène .	
Sloop . . .	Daphne .	
„ . . .	Nymphe .	
Gunboat . . .	Peacock .	
„ . . .	Pigeon .	
„ . . .	Plover . .	
„ . . .	Pheasant .	
„ . . .	Partridge .	
„ . . .	Pigmy . .	

SUMMARY SHOWING THE AGGREGATE COST OF CONSTRUCTION OF EFFECTIVE AND NON-EFFECTIVE SHIPS AT PRESENT ON THE STRENGTH OF THE ROYAL NAVY, UNDER THE YEARS OF THEIR COMPLETION.

SUMMARY showing the Aggregate Cost of Construction of Effective Navy, under the years

For Details See Statement. No.	CLASS OF SHIP.	Prior to 1865-66.	1865-66.	1866-67.	1867-68.	1868-69.	1869-70.	1870-71.	1871-72.	1872-73.	1873-74.	1874-75.	1875-76.
	1. EFFECTIVE SHIPS:												
	COMBATANT:	£	£	£	£	£	£	£	£	£	£	£	£
1	Armoured . .	377,954	438,728	413,043	531,817	1,547,480	371,415	714,257	773,873	267,718	771,253	239,197	..
1	Protected . .	..	..	..	..	..	..	..	..	..	..	..	..
1	Partially protected	..	..	..	..	..	..	..	..	..	..	..	..
	Unprotected, viz.:												
1	Frigates . . .	..	..	..	..	..	226,260	..	..	..	..	210,234	..
1	Corvettes . . .	..	..	..	..	..	132,817	274,821	..	..	..	..	453,536
1	Sloops . . .	..	..	..	..	..	..	..	..	..	..	90,916	..
1	Torpedo Cruisers	..	..	..	..	..	..	..	..	..	..	..	..
1	Gun-Vessels . .	..	..	44,446	40,480	21,879	..	..	59,184	..	54,297	..	36,661
1	Gun-Boats . .	..	..	..	..	..	..	..	..	31,655	52,607	..	61,121
1	Gun-boats, Coast Defence . . .	..	..	..	..	6,719	..	7,751	79,799	54,059	43,854	..	..
1	Despatch Vessels, &c.	249,022	46,992	..	..	..	..	..	..	..	..	124,324	..
1	Torpedo Boats, Launches, &c. .	..	..	..	..	..	..	..	..	..	..	..	..
	£	626,976	485,720	457,489	572,297	1,576,078	730,492	996,829	912,856	353,432	922,011	664,671	551,3[illegible]
	NON-COMBATANT:												
1	Troop and Store Ships . . .	382,114	..	..	..	..	..	..	..	..	21,500	..	101,625
..	Small Steam Vessels, Tugs, Tanks, &c. . .	136,142	2,159	24,462	13,187	26,514	7,831	..	..	..	57,209	..	50,521
	2. NON-EFFECTIVE SHIPS:												
..	Ships capable of being fitted, but not ordered . .	1,143,996	..	..	..	147,805	247,282	..	8,740	..	158,281	42,932	37,532
..	Ships unfit for Service, ordered to be sold, &c. .	2,672,118	334,854	..	458,494	252,184	26,367	..	80,759	128,110	156,953	42,485	66,051
	3. GUARD, RECEIVING, &c., SHIPS:												
..	Guard, Receiving, &c., Ships . .	2,962,770	..	14,137	48,469	..	..	..	..	16,230	6,541	8,018	..
	4. SHIPS NOT COMPLETE:												
..	Armoured . .	..	..	..	..	..	..	..	..	..	..	..	..
..	Protected . .	..	..	..	..	..	..	..	..	..	..	..	..
..	Partially Protected	..	..	..	..	..	..	..	..	..	..	..	..
..	Unprotected . .	..	..	..	..	..	..	..	..	..	..	..	..
	TOTAL . £	7,924,116	822,733	496,088	1,092,447	2,002,581	1,011,972	996,829	1,002,355	497,772	1,322,495	758,106	807,037

and Non-Effective Ships at present on the Strength of the Royal
of their completion.

1876–77.	1877–78.	1878–79.	1879–80.	1880–81.	1881–82.	1882–83.	1883–84.	1884–85.	1885–86.	1886–87.	Total First Cost.	Expended on Vessels not yet Complete.	Outstanding Liabilities on Ships Commenced.
£	£	£	£	£	£	£	£	£	£	£	£	£	£
682,626	1,461,069	886,918	414,434	531,846	1,912,964	296,761	..	530,015	1,210,583	2,227,662	19,417,368	..	..
..	..	..	..	..	..	226,305	..	..	..	..		..	..
..	..	123,913	368,177	122,681	246,059	140,453	204,775	73,644	1,120,118	189,630		..	..
249,974	..	..	..	..	..	..	..	..	..	..	686,468	..	..
103,429	207,268	209,712	240,103	..	..	..	..	..	..	..	6,070,994	..	..
..	228,257	165,058	..	52,867	105,363	..	53,871	263,100	..	177,826		..	..
..	..	..	..	..	..	..	..	..	..	223,308		..	..
..	155,439	..	..	197,631	..	..	..	..	..	111,163		..	..
..	93,484	48,961	..	..	91,979	115,962	32,783	65,584	..	..		..	..
..	40,714	217,838	47,500	..	23,478	..	..	..	..	..		..	..
..	..	..	224,052	61,606	23,570	48,565	307,902	..	..	165,691		..	..
..	..	..	..	..	..	..	..	..	..	..	*1,500,000	..	..
1,036,029	2,186,231	1,652,400	1,294,266	966,631	2,403,413	828,046	599,331	932,343	2,330,701	3,095,280	26,174,830 *1,500,000	..	..
..	..	123,078	..	..	..	..	..	..	..	..	628,317	..	..
..	25,546	..	..	4,200	9,452	23,000	53,503	..	13,801	..	447,527	..	..
267,230	..	276,527	..	..	..	..	..	..	36,684	..	6,585,384	..	..
..	..	..	..	..	..	..	..	..	..	..		..	..
..	1,925	126,517	38,598	4,992	13,350	..	12,859	..	15,260	..	3,269,666	..	..
..	..	..	..	..	..	..	..	..	..	..	..	(a) 6,392,934	(b) *3,079,537*
..	..	..	..	..	..	..	..	..	..	..	..	746,780	*97,334*
..	..	..	..	..	..	..	..	..	..	..	..	..	..
..	..	..	..	..	..	..	..	..	..	..	..	766,991	*267,705*
1,303,259	2,213,702	2,178,522	1,332,864	975,823	2,426,215	851,046	665,693	932,343	2,396,446	3,095,280	37,105,724 *1,500,000	7,906,705	*3,444,574*

* It is estimated that of this sum about £750,000 relates to vessels completed prior to 1885–86.

(a) Includes £401,120 on account of Nile and Trafalgar.

(b) Includes *£1,259,939* on account of Nile and Trafalgar.

STATEMENT.—Showing the First Cost of each Effective Ship of th
upon Repai

Name of Ship.	1865–6.	1866–7.	1867–8.	1868–9.	1869–70.	1870–1.	1871–2.	1872–3.	1873–4.	1874–5.	187
ARMOURED SHIPS:	£	£	£	£	£	£	£	£	£	£	£
Black Prince	..	..	..	..	..	..	..	..	..	..	
Prince Albert	208,345	..	..	..	..	..	..	..	..	..	
Scorpion	111,614	..	..	..	..	..	..	..	..	..	
Wivern	118,769	..	..	..	..	..	..	..	..	..	
Bellerophon	..	356,493	..	..	..	..	..	..	..	..	
Vixen	..	56,550	..	..	..	..	..	..	..	..	
Minotaur	..	..	478,360	..	..	..	..	..	..	..	
Viper	..	..	53,457	..	..	..	..	..	..	..	
Agincourt	..	..	..	483,003	..	..	..	..	..	..	
Hercules	..	..	..	377,008	..	..	..	..	..	..	
Northumberland	..	..	..	490,680	..	..	..	..	..	..	
Penelope	..	..	..	196,789	..	..	..	..	..	..	
Monarch	..	..	..	..	371,415	..	..	..	..	..	
Audacious	..	..	..	..	..	256,291	..	..	..	..	
Invincible	..	..	..	..	..	249,203	..	-	..	..	
Iron Duke	..	..	..	..	..	208,763	..	..	..	..	
Sultan	..	..	..	..	..	..	374,777	..	..	..	
Hotspur	..	..	..	..	..	..	175,995	..	..	..	
Glatton	..	..	..	..	..	..	223,101	..	..	..	
Swiftsure	..	..	..	..	..	..	..	267,718	..	..	
Devastation	..	..	..	..	..	..	..	..	361,438	..	
Gorgon	..	..	..	..	..	..	..	..	141,254	..	
Triumph	..	..	..	..	..	..	..	..	268,561	..	
Rupert	..	..	..	..	..	..	..	..	..	[illegible]	
Alexandra	..	..	..	..	..	..	..	..	..	..	[illegible]
Hydra	..	..	..	..	..	..	..	..	..	..	[illegible]
Cyclops	..	..	..	..	..	..	..	..	..	..	
Hecate	..	..	..	..	..	..	..	..	..	..	
Shannon	..	..	..	..	..	..	..	..	..	..	
Teméraire	..	..	..	..	..	..	..	..	..	..	
Thunderer	..	..	..	..	..	..	..	..	..	..	
Belleisle	..	..	..	..	..	..	..	..	..	..	
Dreadnought	..	..	..	..	..	..	..	..	..	..	
Northampton	..	..	..	..	..	..	..	..	..	..	
Superb	..	..	..	..	..	..	..	..	..	..	
Inflexible	..	..	..	..	..	..	..	..	..	..	
Nelson	..	..	..	..	..	..	..	..	..	..	
Neptune	..	..	..	..	..	..	..	..	..	..	
Orion	..	..	..	..	..	..	..	..	..	..	
Agamemnon	..	..	..	..	..	..	..	..	..	..	
Ajax	..	..	..	..	..	..	..	..	..	..	
Colossus	..	..	..	..	..	..	..	..	..	..	
Edinburgh	..	..	..	..	..	..	..	..	..	..	
Conqueror	..	..	..	..	..	..	..	..	..	..	
Collingwood	..	..	..	..	..	..	..	..	..	..	
Imperieuse	..	..	..	..	..	..	..	..	..	..	
Total Armoured Ships . . £	438,728	413,043	531,817	1,547,480	371,415	714,257	773,873	267,718	771,253	[illegible]	[illegible]
PROTECTED SHIP:											
Polyphemus	..	..	..	..	..	..	..	..	..	..	–
Total Protected Ship . . .	..	..	..	..	..	..	..	..	..	..	..

YAL NAVY under the Year of completion, with the subsequent OUTLAY
TERATIONS, &c.

877-8.	1878-9.	1879-80.	1880-1.	1881-2.	1882-3.	1884-5.	1885-6.	1886-7.	Cost after Completion (to 31 March, 1886.)	NAME OF SHIP.
£	£	£	£	£	£	£	£	£	£	**ARMOURED SHIPS:**
..	..	..	..	..	..	..	..	..	274,354	Black Prince.
..	..	..	..	..	..	..	..	..	45,087	Prince Albert.
..	..	..	..	..	..	..	..	..	40,053	Scorpion.
..	..	..	..	..	..	..	..	..	81,297	Wivern.
..	..	..	..	..	..	..	..	..	241,699	Bellerophon.
..	..	..	..	..	..	..	..	..	7,930	Vixen.
..	..	..	..	..	..	..	..	..	231,340	Minotaur.
..	..	..	..	..	..	..	..	..	11,143	Viper.
..	..	..	..	..	..	..	..	..	202,119	Agincourt.
..	..	..	..	..	..	..	..	..	184,077	Hercules.
..	..	..	..	..	..	..	..	..	201,773	Northumberland.
..	..	..	..	..	..	..	..	..	94,291	Penelope.
..	..	..	..	..	..	..	..	..	203,614	Monarch.
..	..	..	..	..	..	..	..	..	182.996	Audacious.
..	..	..	..	..	..	..	..	..	134,014	Invincible.
..	..	..	..	..	..	..	..	..	183,564	Iron Duke.
..	..	..	..	..	..	..	..	..	178,623	Sultan.
..	..	..	..	..	..	..	..	..	151,025	Hotspur.
..	..	..	..	..	..	..	..	..	41,018	Glatton.
..	..	..	..	..	..	..	..	..	102,264	Swiftsure.
..	..	..	..	..	..	..	..	..	105,346	Devastation.
..	..	..	..	..	..	..	..	..	25,941	Gorgon.
..	..	..	..	..	..	..	..	..	147,669	Triumph.
..	..	..	..	..	..	..	..	..	53,897	Rupert.
..	..	..	..	..	..	..	..	..	63,591	Alexandra.
..	..	..	..	..	..	..	..	..	15,647	Hydra.
56,782	..	..	..	..	..	..	..	..	15,962	Cyclops.
43,310	..	..	..	..	..	..	..	..	82,387	Hecate.
02,727	..	..	..	..	..	..	..	..	53,156	Shannon.
89,822	..	..	..	..	..	..	..	..	52,246	Teméraire.
68,428	..	..	..	..	..	..	..	..	57,391	Thunderer.
..	267,197	..	..	..	..	..	..	..	20,098	Belleisle.
..	619,739	..	..	..	..	..	..	..	42,925	Dreadnought.
..	..	414,434	..	..	..	..	..	..	23,557	Northampton.
..	..	..	531,846	..	..	..	..	..	28,316	Superb.
..	..	..	..	812,485	..	..	..	..	43,382	Inflexible.
..	..	..	..	411,308	..	..	..	..	12,651	Nelson.
..	..	..	..	689,171	..	..	..	..	12,588	Neptune.
..	..	..	..	..	296,761	..	..	..	14,377	Orion.
..	..	..	..	..	..	530,015	..	..	10,465	Agamemnon.
..	..	..	..	..	..	..	548,393	..	3,547	Ajax.
..	..	..	..	..	..	..	662,190	..	4,987	Colossus.
..	..	..	..	..	..	..	..	662,773	152	Edinburgh.
..	..	..	..	..	..	..	..	399,919	884	Conqueror.
..	..	..	..	..	..	..	..	627,375	974	Collingwood.
..	..	..	..	..	..	..	..	537,595	3,120	Imperieuse.
61,069	886,918	414,434	531,846	1,912,964	296,761	530,015	1,210,583	2,227,662	..	Total Armoured Ships.
										PROTECTED SHIP:
..	..	..	..	..	226,305	..	..	..	42,178	Polyphemus.
..	..	..	..	..	226,305	..	..	..	..	Total Protected Ship.

STATEMENT

NAME OF SHIP.	1869-70.	1870-71.	1874-75.	1875-76.	1876-77.	1877-78.	1878-79.	1879-80.
PARTIALLY PROTECTED SHIPS:	£	£	£	£	£	£	£	£
Comus	..	..	..	..	..	..	123,913	..
Carysfort	..	..	..	..	..	..	..	123,6
Champion	..	.	..	..	..	..	..	122,9
Curaçoa	..	..	..	..	..	..	..	121,5
Cleopatra	..	..	..	..	..	..	..	..
Constance	..	..	..	..	..	..	..	
Conquest	..	..	..	..	..	..	..	.
Heroine	..	..	..	..	..	..	..	
Satellite	..	..	..	..	..	..	..	
Canada	..	..	..	..	..	..	..	
Hyacinth	..	..	..	..	..	..	..	..
Rapid	..	..	..	..	..	..	..	
Cordelia	..	..	..	..	..	..	..	.
Caroline	..	..	..	..	..	..	..	
Royalist	..	..	..	..	..	..	..	
Calypso	..	..	..	..	..	..	..	
Leander	..	..	..	..	..	..	.	
Amphion	..	..	..	..	..	..	..	
Phaeton	..	..	..	..	..	..	..	.
Pylades	..	..	..	..	..	..	.	
Arethusa	..	..	..	..	..	..	..	
Total Partially Protected Ships £	..	..	..	..	..	..	123,913	[illegible]
UNPROTECTED SHIPS:								
FRIGATES—								
Inconstant	226,260	..	..	..	..	..	..	..
Raleigh	..	..	210,234	..	..	..	..	..
Shah	..	..	..	..	249,974	..	..	..
Total Frigates £	226,260	..	210,234	..	249,974	..	..	..
CORVETTES—								
Volage	132,817	..	..	..	..	..	..	
Active	..	132,102	..	..	..	..	..	
Briton	..	66,726	..	..	..	..	..	
Thalia	..	75,993	..	..	..	..	..	
Diamond	..	..	..	85,770	..	..	..	
Opal	..	..	..	102,824	..	..	..	
Rover	..	..	..	178,033	..	..	..	
Sapphire	..	..	..	86,899	..	..	..	
Tourmaline	..	..	..	..	103,429	..	..	
Ruby	..	..	..	..	..	102,024	..	
Turquoise	..	..	..	..	..	105,244	..	
Emerald	..	..	..	..	..	..	107,424	
Garnet	..	..	..	..	..	..	102,288	
Bacchante	..	..	..	..	..	..	..	[illegible]
Total Corvettes	132,817	274,821	..	453,526	103,429	207,268	209,712	[illegible]

continued.

1880–81.	1881–82.	1882–83.	1883–84.	1884–85.	1885–86.	1886–87.	Cost after Completion (to 31 March, 1886.)	**Name of Ship.**
£	£	£	£	£	£	£	£	**PARTIALLY PROTECTED SHIPS:**
..	..	..	..	..	..	..	47,595	Comus.
..	..	..	..	..	..	..	12,556	Carysfort.
..	..	..	..	..	..	..	8,090	Champion.
..	..	..	..	..	..	..	10,207	Curaçoa.
122,681	..	..	..	..	..	..	7,495	Cleopatra.
..	123,015	..	..	..	..	..	8,050	Constance.
..	123,044	..	..	..	..	..	10,618	Conquest.
..	..	72,397	..	..	..	..	457	Heroine.
..	..	68,056	..	..	..	..	2,106	Satellite.
..	..	..	131,565	..	..	..	5.456	Canada.
..	..	..	73,210	..	..	..	2,649	Hyacinth.
..	..	..	..	73,644	..	..	1,867	Rapid.
..	..	..	..	..	130,875	..	2,221	Cordelia.
..	..	..	..	..	80,800	..	3,773	Caroline.
..	..	..	..	..	78,343	..	1,883	Royalist.
..	..	..	..	..	165,552	..	3,562	Calypso.
..	..	..	..	..	191,882	..	8,947	Leander.
..	..	..	..	..	201,658	..	2,692	Amphion.
..	..	..	..	..	188,937	..	2,460	Phaeton.
..	..	..	..	..	82,071	..	1,693	Pylades.
..	..	..	..	..	..	189,630	2,127	Arethusa.
122,681	246,059	140,453	204,775	73,644	1,120,118	189,630	..	Total Partially Protected Ships.
								UNPROTECTED SHIPS:
								Frigates—
..	..	..	..	..	..	..	115,597	Inconstant
..	..	..	..	..	..	..	137,979	Raleigh.
..	..	..	..	..	..	..	39,504	Shah.
..	..	..	..	..	..	..	..	Total Frigates.
								Corvettes—
..	..	..	..	..	..	..	93,412	Volage.
..	..	..	..	..	..	..	104,534	Active.
..	..	..	..	..	..	..	50,189	Briton.
..	..	..	..	..	..	..	57,724	Thalia.
..	..	..	..	..	..	..	38,407	Diamond.
..	..	..	..	..	..	..	46,807	Opal.
..	..	..	..	..	..	..	58,309	Rover.
..	..	..	..	..	..	..	40,278	Sapphire.
..	..	..	..	..	..	..	49,681	Tourmaline.
..	..	..	..	..	..	..	44,281	Ruby.
..	..	..	..	..	..	..	40,778	Turquoise.
..	..	..	..	..	..	..	48,289	Emerald.
..	..	..	..	..	..	..	18,775	Garnet.
..	..	..	..	..	..	..	47,719	Bacchante.
..	..	..	..	..	..	..	..	Total Corvettes.

STATEMENT

NAME OF SHIPS.	1866-67.	1867-68.	1868-69.	1871-72.	1873-74.	1874-75.	1875-76.
UNPROTECTED SHIPS—*continued.*	£	£	£	£	£	£	£
SLOOPS—							
Egeria . . .	..	..	..	..	..	47,110	..
Flying Fish .	..	..	..	..	..	43,806	..
Osprey . . .	..	..	..	..	..	..	..
Pelican . . .	..	..	..	..	..	..	..
Penguin . .	..	..	..	..	..	..	..
Wild Swan .	..	..	..	..	..	..	..
Cormorant . .	..	..	..	..	..	..	..
Dragon . . .	..	..	..	..	..	..	..
Gannet . . .	..	..	..	..	..	..	..
Miranda . .	..	..	..	..	..	..	..
Espiegle . .	..	..	..	..	..	..	..
Mutine . . .	..	..	..	..	..	..	..
Kingfisher . .	..	..	..	..	..	..	..
Dolphin . .	..	..	..	..	..	..	..
Mariner . .	..	..	..	..	..	..	..
Wanderer . .	..	..	..	..	..	..	..
Reindeer . .	..	..	..	..	..	..	..
Racer . . .	..	..	..	..	..	..	..
Acorn . . .	..	..	..	..	..	..	..
Icarus . . .	..	..	..	..	..	..	..
Swallow . .	..	..	..	..	..	..	..
Total Sloops. .	..	..	..	..	..	90,916	..
TORPEDO CRUISERS							
Scout . . .	..	..	..	..	..	..	..
Fearless . .	..	..	..	..	..	..	..
Archer . . .	..	..	..	..	..	..	..
Total Torpedo Cruisers . £	..	..	..	..	..	..	..
GUN VESSELS—							
Sylvia . . .	44,446	..	..	..	..	..	..
Myrmidon . .	..	40,480	..	..	..	..	..
Midge . . .	..	..	21,879	..	..	..	..
Frolic . . .	..	..	..	25,843	..	..	..
Woodlark . .	..	..	..	33,341	..	..	..
Ready . . .	..	..	..	..	26,709	..	..
Rifleman . .	..	..	..	..	27,588	..	..
Lily . . .	..	..	..	..	..	..	36,661
Condor . . .	..	..	..	..	..	..	..
Falcon . . .	..	..	..	..	..	..	..
Flamingo . .	..	..	..	..	..	..	..
Griffon . . .	..	..	..	..	..	..	..
Algerine . .	..	..	..	..	..	..	..
Linnet . . .	..	..	..	..	..	..	..
Rambler . .	..	..	..	..	..	..	..
Ranger . . .	..	..	..	..	..	..	..
Swift . . .	..	..	..	..	..	..	..
Curlew . . .	..	..	..	..	..	..	..
Landrail . .	..	..	..	..	..	..	..
Total Gun Vessels . £	44,446	40,480	21,879	59,184	54,297	..	36,661

continued.

1877–78.	1878–79.	1880–81.	1881–82.	1883–84.	1884–85.	1886–87.	Cost after Completion (to 31 March, 1886.)	NAME OF SHIPS.
£	£	£	£	£	£	£	£	**UNPROTECTED SHIPS**—*continued.*
								SLOOPS—
..	..	..	..	..	..	..	15,791	Egeria.
..	..	..	..	..	..	..	20,693	Flying Fish.
56,155	..	..	..	..	..	..	26,570	Osprey.
60,431	..	..	..	..	..	..	26,265	Pelican.
55,800	..	..	..	..	..	..	28,913	Penguin.
55,871	..	..	..	..	..	..	33,277	Wild Swan.
..	53,884	..	..	..	..	..	23,598	Cormorant.
..	53,884	..	..	..	..	..	11,132	Dragon.
..	57,290	..	..	..	..	..	23,740	Gannet.
..	..	52,867	..	..	..	..	2,940	Mirander.
..	..	..	53,025	..	..	..	14,889	Espiegle.
..	..	..	52,338	..	..	..	4,234	Mutine.
..	..	..	..	53,871	..	..	6,124	Kingfisher.
..	..	..	..	..	47,087	..	2,367	Dolphin.
..	..	..	..	..	57,082	..	2,478	Mariner.
..	..	..	..	..	46,232	..	1,683	Wanderer.
..	..	..	..	..	55,052	..	2,254	Reindeer.
..	..	..	..	..	57,647	..	1,804	Racer.
..	..	..	..	..	..	58,034	948	Acorn.
..	..	..	..	..	..	57,721	615	Icarus.
..	..	..	..	..	..	62,071	314	Swallow.
228,257	165,058	52,867	105,363	53,871	263,100	177,826	..	Total Sloops.
								TORPEDO CRUISERS
..	..	..	..	..	..	91,196	73	Scout.
..	..	..	..	..	..	66,371	1	Fearless.
..	..	..	..	..	..	65,741	..	Archer.
..	..	..	..	..	..	223,308	..	Total Torpedo Cruisers.
								GUN VESSELS—
..	..	..	..	..	..	..	51,692	Sylvia.
..	..	..	..	..	..	..	40,472	Myrmidon.
..	..	..	..	..	..	..	20,637	Midge.
..	..	..	..	..	..	..	22,399	Frolic.
..	..	..	..	..	..	..	28,407	Woodlark.
..	..	..	..	..	..	..	27,990	Ready.
..	..	..	..	..	..	..	27,893	Rifleman.
..	..	..	..	..	..	..	19,994	Lily.
37,791	..	..	..	..	..	..	9,206	Condor.
39,977	..	..	..	..	..	..	9,875	Falcon.
38,265	..	..	..	..	..	..	6,172	Flamingo.
39,406	..	..	..	..	..	..	5,646	Griffon.
..	..	40,710	..	..	..	..	689	Algerino.
..	..	38,211	..	..	..	..	2,463	Linnet.
..	..	40,830	..	..	..	..	13,146	Rambler.
..	..	40,844	..	..	..	..	4,767	Ranger.
..	..	37,036	..	..	..	..	3,170	Swift.
..	..	..	..	..	..	56,295	349	Curlew.
..	..	..	..	..	..	54,868	1	Landrail.
155,439	..	197,631	..	..	..	111,163	..	Total Gun Vessels.

STATEMENT

NAME OF SHIP.	1868–69.	1870–71.	1871–72.	1872–73.	1873–74.	1875–76.	1877–78.
UNPROTECTED SHIPS—*continued*.	£	£	£	£	£	£	£
GUN BOATS—							
Goshawk	..	..	..	15,912	..	..	..
Merlin	..	..	..	15,743	..	..	..
Ariel	..	..	..	..	18,478	..	..
Swinger	..	..	..	..	15,888	..	..
Zephyr	..	..	..	..	18,241	..	..
Cygnet	..	..	..	..	..	19,837	..
Express	..	..	..	..	..	19,487	..
Mallard	..	..	..	..	..	21,797	..
Firm	..	..	..	..	..	..	24,437
Forester	..	..	..	..	..	..	24,373
Forward	..	..	..	..	..	..	22,264
Foxhound	..	..	..	..	..	..	22,410
Firebrand	..	..	..	..	..	..	..
Firefly	..	..	..	..	..	..	..
Banterer	..	..	..	..	..	..	..
Bullfrog	..	..	..	..	..	..	..
Grappler	..	..	..	..	..	..	..
Wrangler	..	..	..	..	..	..	..
Espoir	..	..	..	..	..	..	..
Raven	..	..	..	..	..	..	..
Starling	..	..	..	..	..	..	..
Stork	..	..	..	..	..	..	..
Cockchafer	..	..	..	..	..	..	..
Albacore	..	..	..	..	..	..	..
Mistletoe	..	..	..	..	..	..	..
Watchful	..	..	..	..	..	..	..
Total Gun Boats £	..	..	..	31,655	52,607	61,121	93,484
GUN BOATS, COAST DEFENCE—							
Staunch	6,719	..	..	..	..	..	..
Plucky	..	7,751	..	..	..	..	..
Arrow	..	..	8,169	..	..	..	..
Blazer	..	..	8,756	..	..	..	..
Bloodhound	..	..	8,692	..	..	..	..
Bonetta	..	..	8,103	..	..	..	..
Bustard	..	..	8,539	..	..	..	..
Kite	..	..	8,471	..	..	..	..
Mastiff	..	..	8,759	..	..	..	..
Scourge	..	..	10,161	..	..	..	..
Snake	..	..	10,149	..	..	..	..
Badger	..	..	..	8,954	..	..	..
Bulldog	..	..	..	9,059	..	..	..
Fidget	..	..	..	9,006	..	..	..
Pickle	..	..	..	8,986	..	..	..
Pike	..	..	..	9,066	..	..	..
Snap	..	..	..	8,988	..	..	..
Gun Boats, Coast Defence, carried forward	6,719	7,751	79,799	54,059	..	..	..

continued.

1878–79.	1881–82.	1882–83.	1883–84.	1884–85.	1886–87.	Cost after Completion (to 31 March, 1886).	NAME OF SHIP.
£	£	£	£	£	£	£	**UNPROTECTED SHIPS**—*continued.*
							GUN BOATS—
..	..	..	..	..	..	13,955	Goshawk.
..	..	..	..	..	..	24,331	Merlin.
..	..	..	..	..	..	11,194	Ariel.
..	..	..	..	..	..	16,059	Swinger.
..	..	..	..	..	..	15,907	Zephyr.
..	..	..	..	..	..	8,760	Cygnet.
..	..	..	..	..	..	16,096	Express.
..	..	..	..	..	..	15,205	Mallard.
..	..	..	..	..	..	5,564	Firm.
..	..	..	..	..	..	4,730	Forester.
..	..	..	..	..	..	12,544	Forward.
..	..	..	..	..	..	3,076	Foxhound.
24,575	..	..	..	..	..	12,779	Firebrand.
24,386	..	..	..	..	..	10,728	Firefly.
..	22,643	..	..	..	..	3,229	Banterer.
..	24,122	..	..	..	..	2,223	Bullfrog.
..	22,487	..	..	..	..	2,369	Grappler.
..	22,727	..	..	..	..	6,054	Wrangler.
..	..	22,825	..	..	..	1,257	Espoir.
..	..	23,046	..	..	..	781	Raven.
..	..	23,209	..	..	..	1,619	Starling.
..	..	23,201	..	..	..	747	Stork.
..	..	23,681	..	..	..	1,121	Cockchafer.
..	..	..	32,783	..	..	1,372	Albacore.
..	..	..	..	33,057	..	1,350	Mistletoe.
..	..	..	..	32,527	..	551	Watchful.
48,961	91,979	115,962	32,783	65,584	..	..	Total Gun Boats.
							GUN BOATS, COAST DEFENCE—
..	..	..	..	..	..	5,299	Staunch.
..	..	..	..	..	..	5,789	Plucky.
..	..	..	..	..	..	5,208	Arrow.
..	..	..	..	..	..	2,999	Blazer.
..	..	..	..	..	..	11,012	Bloodhound.
..	..	..	..	..	..	2,839	Bonetta.
..	..	..	..	..	..	2,633	Bustard.
..	..	..	..	..	..	3,574	Kite.
..	..	..	..	..	..	2,925	Mastiff.
..	..	..	..	..	..	3,499	Scourge.
..	..	..	..	..	..	5,675	Snake.
..	..	..	..	..	..	1,319	Badger.
..	..	..	..	..	..	3,010	Bulldog.
..	..	..	..	..	..	1,264	Fidget.
..	..	..	..	..	..	1,644	Pickle.
..	..	..	..	..	..	3,229	Pike.
..	..	..	..	..	..	2,809	Snap.
..	..	..	..	..	..	..	Gun Boats, Coast Defence, carried forward.

STATEMENT

NAME OF SHIP.	1855–56.	1863–64.	1865–66.	1868–69.	1870–71.	1871–72.	1872–73.	1873–74.	1874–75.
UNPROTECTED SHIPS—*continued.*									
GUN BOATS, COAST DEFENCE—*contd.*	£	£	£	£	£	£	£	£	£
Brought forward	..	..	..	6,719	7,751	79,799	54,059	..	..
Ant	..	..	..	..	..	..	..	10,969	..
Cuckoo	..	..	..	..	..	..	..	10,970	..
Hyæna	..	..	..	..	..	..	..	10,970	..
Weazel	..	..	..	..	..	..	..	10,945	..
Medina	..	..	..	..	..	..	..	..	..
Medway	..	..	..	..	..	..	..	..	..
Dee	..	..	..	..	..	..	..	..	..
Don	..	..	..	..	..	..	..	..	..
Esk	..	..	..	..	..	..	..	..	..
Sabrina	..	..	..	..	..	..	..	..	..
Slaney	..	..	..	..	..	..	..	..	..
Spey	..	..	..	..	..	..	..	..	..
Tay	..	..	..	..	..	..	..	..	..
Tees	..	..	..	..	..	..	..	..	..
Trent	..	..	..	..	..	..	..	..	..
Tweed	..	..	..	..	..	..	..	..	..
Gadfly	..	..	..	..	..	..	..	..	..
Griper	..	..	..	..	..	..	..	..	..
Pincher	..	..	..	..	..	..	..	..	..
Tickler	..	..	..	..	..	..	..	..	..
Bouncer	..	..	..	..	..	..	..	..	..
Insolent	..	..	..	..	..	..	..	..	..
Total Gun Boats, Coast Defence	..	..	..	6,719	7,751	79,799	54,059	43,854	..
DESPATCH VESSELS—									
Iris	..	..	..	..	..	..	..	..	..
Mercury	..	..	..	..	..	..	..	..	..
Alacrity	..	..	..	..	..	..	..	..	..
Surprise	..	..	..	..	..	..	..	..	..
PADDLE DESPATCH VESSELS—									
Enchantress	..	49,685	..	..	..	..	..	..	..
Helicon	..	..	46,992	..	..	..	..	..	..
YACHTS—									
Dart (purchased)	..	..	..	..	..	..	..	..	..
Imogene (purchased in 1884)	..	..	..	..	..	..	..	..	..
PADDLE YACHTS—									
Victoria and Albert	136,441	..	..	..	..	..	..	..	..
Osborne	..	..	..	..	..	..	..	..	105,919
Despatch Vessels, &c., carried forward	136,441	49,685	46,992	..	..	..	..	..	105,919

continued.

1877–78.	1878–79.	1879–80.	1881–82.	1882–83.	1883–84.	1886–87.	Cost after Completion (to 31 March, 1886).	Name of Ship.
								UNPROTECTED SHIPS—*continued.*
£	£	£	£	£	£	£	£	Gun Boats, Coast Defence—*cont.*
..	..	..	..	..	..	..	..	Brought forward.
..	..	..	..	..	..	..	2,265	Ant.
..	..	..	..	..	..	..	3,956	Cuckoo.
..	..	..	..	..	..	..	1,581	Hyæna.
..	..	..	..	..	..	..	1,876	Weazel.
20,468	..	..	..	..	..	..	5,367	Medina.
20,246	..	..	..	..	..	..	6,058	Medway.
..	21,993	..	..	..	..	..	5,594	Dee.
..	22,058	..	..	..	..	..	5,671	Don.
..	21,112	..	..	..	..	..	6,117	Esk.
..	21,591	..	..	..	..	..	4,793	Sabrina.
..	21,652	..	..	..	..	..	3,311	Slaney.
..	22,397	..	..	..	..	..	1,890	Spey.
..	21,863	..	..	..	..	..	4,380	Tay.
..	22,269	..	..	..	..	..	1,965	Tees.
..	21,323	..	..	..	..	..	5,556	Trent.
..	21,580	..	..	..	..	..	5,352	Tweed.
..	..	11,941	..	..	..	..	1,579	Gadfly.
..	..	11,808	..	..	..	..	1,158	Griper.
..	..	11,931	..	..	..	..	1,578	Pincher.
..	..	11,820	..	..	..	..	1,239	Tickler.
..	..	..	11,742	..	..	..	1,524	Bouncer.
..	..	..	11,736	..	..	..	1,498	Insolent.
40,714	217,838	47,500	23,478	..	..	..	..	Total Gun Boats, Coast Defence.
								Despatch Vessels—
..	..	224,052	..	..	..	..	29,438	Iris.
..	..	..	..	..	234,860	..	16,009	Mercury.
..	..	..	..	..	..	82,762	212	Alacrity.
..	..	..	..	..	..	82,929	443	Surprise.
								Paddle Despatch Vessels—
..	..	..	..	..	..	..	73,603	Enchantress.
..	..	..	..	..	..	..	46,321	Helicon.
								Yachts—
..	..	..	..	15,229	..	..	1,361	Dart (purchased).
..	..	..	..		18,023	..	1,270	Imogene (purchased in 1884).
								Paddle Yachts—
..	..	..	..	..	..	..	300,671	Victoria and Albert.
..	..	..	..	..	..	..	111,633	Osborne.
..	..	224,052	..	15,229	252,883	165,691	..	Despatch Vessels, &c., carried forward.

STATEMENT

NAME OF SHIP.	1823–4.	1826–7.	1846–7.	1848–9.	1849–50.	1854–5.	1855–6.	1863–4.	1865–6.	1873–4.
UNPROTECTED SHIPS—*continued.*										
DESPATCH VESSELS—*continued.*	£	£	£	£	£	£	£	£	£	£
Brought forward .	..	..	..	..	..	..	136,441	49,685	46,992	..
SPECIAL SERVICE STEAMERS—										
Screw—										
Seahorse . .	..	..	..	..	..	..	..	..	..	..
Paddle—										
Sphinx . . .	..	..	..	..	..	..	..	..	..	..
PADDLE SMALL STEAMERS—										
Sprightly . . .	10,429	..	..	..	..	..	..	..	..	..
Wildfire . . .	..	9,658	..	..	..	..	..	..	..	..
Harpy	..	..	17,193	..	..	..	..	..	..	..
Vivid	..	..	..	19,448	..	..	..	..	..	..
Elfin	..	..	..	..	6,168	..	..	..	..	..
Cockatrice . .	..	..	..	..	..	..	..	..	..	..
Triton	..	..	..	..	..	..	..	..	..	..
Alecto . . .	..	..	..	..	..	..	..	..	..	..
						..	..	..	..	
TORPEDO VESSEL—						..	..	..	..	
Vesuvius . . .	..	..	..	..	..	..	..	..	..	..
Total Despatch Vessels, &c. .	10,429	9,658	17,193	19,441	6,168	..	136,144	49,685	46,992	..
TROOP AND STORE SHIPS.										
Himalaya (purchased) . . .	..	..	..	..	..	130,000	..	..	..	..
Orontes . . .	..	..	..	..	..	..	..	124,117	..	..
Tamar. . . .	..	..	..	..	..	..	..	127,997	..	..
Wye (purchased). .	..	..	..	..	..	..	..	..	..	21,500
Assistance . .	..	..	..	..	..	..	..	..	..	..
Humber (purchased in 1878)	..	..	..	..	..	..	..	..	..	..
Tyne (purchased in 1878) . .	..	..	..	..	..	..	..	..	..	..
Total Troop and Store Ships £	..	..	..	..	..	130,000	..	252,114	..	21,500

continued.

1874–5.	1875–6.	1878–9.	1879–80.	1880–1.	1881–2.	1882–3.	1883–4.	1886–7.	Cost after Completion (to 31 March, 1886).	NAME OF SHIP.
										UNPROTECTED SHIPS—*continued.*
										DESPATCH VESSELS —*continued.*
£	£	£	£	£	£	£	£	£	£	
105,919	..	..	224,052	..	..	15,229	252,883	165,691	..	Brought forward
										SPECIAL SERVICE STEAMERS—
										Screw—
..	..	..	..	29,225	..	..	..	..	6,297	Seahorse.
										Paddle—
..	..	..	..	..	..	..	55,019	..	1,693	Sphinx.
										PADDLE SMALL STEAMERS—
..	..	..	..	..	..	..	..	..	38,552	Sprightly.
..	..	..	..	..	..	..	..	..	26,124	Wildfire.
..	..	..	..	..	..	..	..	..	41,549	Harpy.
..	..	..	..	..	..	..	..	..	46,590	Vivid.
..	..	..	..	..	..	..	..	..	40,851	Elfin.
..	..	..	..	32,381	..	..	..	..	2,555	Cockatrice.
..	..	..	..	..	23,570	..	..	..	2,290	Triton.
..	..	..	..	..	..	33,336	..	..	2,327	Alecto.
										TORPEDO VESSEL—
18,405	..	..	..	..	..	..	..	..	10,033	Vesuvius.
124,324	..	..	224,052	61,606	23,570	48,565	307,902	165,691	..	Total Despatch Vessels, &c.
										TROOP AND STORE SHIPS.
..	..	..	..	..	..	..	..	..	460,698	Himalaya (purchased).
..	..	..	..	..	..	..	..	..	334,767	Orontes.
..	..	..	..	..	..	..	..	..	283,575	Tamar.
..	..	..	..	..	..	..	..	..	36,318	Wye (purchased).
..	101,625	..	..	..	..	..	..	..	40,186	Assistance.
..	..	40,914	..	..	..	..	..	..	24,878	Humber (purchased in 1878).
..	..	82,164	..	..	..	..	..	..	39,569	Tyne (purchased in 1878).
..	101,625	123,078	..	..	..	..	..	..	..	Total Troop and Store Ships.

STATEMENT of the ACTUAL EXPENDITURE for NAVAL SERVICE (excluding the Conveyance of Troops), for each Year from 1860–61 to 1886–87, inclusive, showing respectively the Effective and Non-Effective Expenditure.

(Estimated Expenditure for the Years 1886–87 and 1887–88 has been inserted.)

Year.	Effective.	Non-Effective.	Total.	Year.
	£	£	£	
1860–61 . . .	10,735,607	1,293,277	12,028,884	1860–61
1861–62 . . .	10,769,206	1,324,904	12,094,110	1861–62
1862–63 . . .	9,729,698	1,345,456	11,075,154	1862–63
1863–64 . . .	8,893,160	1,351,912	10,245,072	1863–64
1864–65 . . .	8,903,219	1,350,226	10,253,445	1864–65
1865–66 . . .	8,517,119	1,387,623	9,904,742	1865–66
1866–67 . . .	8,527,797	1,416,427	9,944,224	1866–67
1867–68 . . .	9,464,500	1,432,371	10,896,871	1867–68
1868–69 . . .	9,302,017	1,443,161	10,745,178	1868–69
1869–70 . . .	7,976,286	1,533,369	9,509,655	1869–70
1870–71 . . .	7,957,205	1,713,133	9,670,338	1870–71
1871–72 . . .	7,894,854	1,724,570	9,619,424	1871–72
1872–73 . . .	7,602,925	1,771,403	9,374,328	1872 73
1873–74 . . .	8,376,223	1,802,819	10,179,042	1873–74
1874–75 . . .	8,660,016	1,846,504	10,506,520	1874–75
1875–76 . . .	8,853,173	1,869,451	10,722,624	1875–76
1876–77 . . .	9,152,357	1,887,571	11,039,928	1876–77
1877–78 . . .	10,435,442	1,910,906	12,346,348	1877–78
1878–79 . . .	9,001,199	1,941,448	10,942,647	1878–79
1879–80 . . .	8,196,075	2,005,498	10,201,573	1879–80
1880–81 . . .	8,055,875	2,059,300	10,115,175	1880–81
1881–82 . . .	8,363,392	2,079,026	10,442,418	1881–82
1882–83* . . .	8,594,373	2,067,811	10,662,184	1882–83
1883–84 . . .	8,436,845	2,077,204	10,514,049	1883–84
1884–85 . . .	8,834,752	2,061,378	10,896,130	1884–85
1885–86 . . .	12,125,610	2,054,900	14,180,510†	1885–86
1886–87 . . .	10,589,600	2,052,000	12,941,600	1886–87
1887–88 . . .	10,274,700	2,037,000	12,311,700	1887–88

* From this date extra receipts were taken in aid of the votes.

† Including Vote of Credit.

ABSTRACT OF THE ENGLISH NAVY ESTIMATES FROM 1866-67 TO 1887-88.

Abstract of the English Navy Estimates,

—	Vote.	1866–67.	1867–68.	1868–69.	1869–70.	1870–71.	1871–72.
	—	Numbers, 67,238.	Numbers, 67,300.	Numbers, 67,120.	Numbers, 63,300.	Numbers. 61,000.	Numbers, 61,000.
		£	£	£	£	£	£
Wages to Seamen and Marines	1	2,866,559	2,950,952	3,036,634	2,762,353	2,692,731	2,723,336
Victuals and Clothing for Seamen and Marines.	2	1,235,188	1,241,614	1,335,842	1,172,268	968,857	1,038,202
Admiralty Office . .	3	178,655	176,018	182,364	168,704	159,368	163,499
Coast Guard Service, Royal Naval Reserves, &c.	4	274,119	267,067	243,926	224,073	196,955	187,830
Scientific Branch . .	5	63,958	65,106	63,565	62,820	68,794	67,103
Dockyards, &c., at Home and Abroad.	6	1,376,971	1,375,368	1,223,562	1,086,004	878,352	967,418
Victualling Yards, at Home and Abroad.	7	85,624	86,395	87,179	80,671	69,267	68,334
Medical Establishments, at Home and Abroad.	8	59,289	62,686	64,824	54,757	57,730	57,906
Marine Divisions . .	9	15,550	17,448	0,709	16,566	18,122	18,021
Naval Stores . . .	10 I	1,003,501	855,511	892,908	801,572	779,090	837,965
Machinery and Ships built by Contract.	10 II	338,000	860,559	1,092,500	767,070	466,173	751,716
New Works, Buildings, &c.	11	892,865	888,588	814,237	749,816	744,232	850,994
Medicines and Medical Stores	12	75,664	80,664	78,164	79,300	73,150	67,600
Martial Law, &c. . .	13	20,605	21,332	20,365	18,144	16,678	16,005
Miscellaneous Services .	14	105,950	168,450	175,800	120,650	118,791	127,617
Half-Pay, &c. . . .	15	701,708	704,937	700,166	723,231	902,100	829,238
Military Pensions and Allowances.	16 I	528,904	528,667	550,447	569,728	635,666	633,785
Civil Pensions and Allowances	16 II	213,837	218,915	223,498	222,566	287,134	312,237
		10,031,947	10,570,277	10,806,690	9,680,293	9,133,190	9,718,806
Army Department (Conveyance of Troops).	17	402,788	405,976	350,600	316,348	237,340	173,150
		10,434,735	10,976,253	11,157,290	9,966,641	9,370,530	8,891,956

FROM 1866–67 TO 1887–88.

1872–73.	1873–74.	1874–75.	1875–76.	1876–77.	1877–78.	1878–79.	1879–80.	1880–81.
Numbers, 61,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 60,000.	Numbers, 58,800.	Numbers. 58,800.
£	£	£	£	£	£	£	£	£
2,674,145	2,629,884	2,603,757	2,644,062	2,634,904	2,684,048	2,707,240	2,708,695	2,721,536
1,062,269	1,035,719	1,085,534	1,107,781	1,153,367	1,178,610	1,146,192	1,003,375	1,013,524
173,767	174,983	178,066	183,916	189,820	193,890	200,760	185,400	179,485
174,500	167,575	163,311	188,505	210,230	207,900	207,510	193,870	194,278
72,741	98,654	113,120	107,324	109,194	109,002	106,041	105,576	113,107
978,983	1,152,080	1,253,326	1,326,649	1,323,750	1,341,680	1,446,140	1,355,000	1,363,585
68,344	70,935	73,385	75,548	76,400	76,930	76,740	76,570	71,160
59,926	62,214	63,701	64,644	65,830	66,150	66,400	67,030	63,445
18,728	18,683	18,720	18,868	20,053	21,316	21,139	21,408	21,402
928,510	1,120,380	1,175,159	1,285,770	1,261,320	1,207,300	1,382,300	1,030,000	1,011,000
477,116	629,366	828,679	903,608	1,353,600	1,042,000	1,152,000	842,000	749,000
716,091	682,218	682,061	644,751	569,249	537,715	540,615	566,749	558,950
70,800	70,800	70,745	73,530	76,230	78,010	79,730	75,710	75,150
16,110	16,080	15,605	15,904	15,114	8,147	7,994	7,985	9,250
117,297	105,288	123,410	156,423	143,547	130,134	139,725	140,530	135,760
818,626	862,462	870,166	889,511	888,472	880,796	891,605	891,615	895,156
638,311	643,216	657,090	681,781	726,136	759,940	790,297	803,920	823,219
309,185	296,448	288,670	284,529	282,176	279,981	284,223	301,211	322,428
9,375,449	9,836,985	10,264,505	10,653,104	11,099,392	10,803,549	11,266,651	10,376,644	10,321,435
156,700	167,740	175,600	172,090	197,480	204,080	863,250	210,250	381,500
9,532,149	10,004,725	10,440,105	10,825,194	11,296,872	11,007,629	12,129,901	10,586,894	10,702,935

ABSTRACT OF THE ENGLISH NAVY ESTIMATES—*continued.*

	VOTE.	1881–82.	1882–83.	1883–84.	1884–85.	1885–86.	1886–87.'	1887–88.
——	—	Numbers, 58,100.	Numbers, 57,500.	Numbers, 57,250.	Numbers, 56,950.	Numbers, 61,500.	Numbers, 61,400.	Numbers, 62,500.
		£	£	£	£	£	£	£
Wages to Seamen and Marines.	1	2,704,226	2,803,941	2,754,700	2,839,490	2,894,805	3,021,635	3,063,739
Victuals and Clothing for Seamen and Marines.	2	1,014,481	1,313,227	1,232,700	1,196,239	1,221,361	1,246,800	1,277,850
Admiralty Office .	3	108,583	186,147	187,387	192,970	202,820	201,420	215,820
Coast Guard Service, Royal Naval Reserves, &c.	4	194,481	195,416	195,800	196,900	205,300	207,667	204,967
Scientific Branch .	5	120,382	131,791	130,976	131,600	132,465	134,638	135,946
Dockyards, &c., at Home and Abroad.	6	1,446,346	1,447,736	1,561,858	1,586,170	1,672,270	1,730,317	1,733,417
Victualling Yards, at Home and Abroad.	7	71,917	71,950	72,007	71,230	71,400	70,760	71,900
Medical Establishments, at Home and Abroad.	8	65,969	64,515	64,950	69,450	67,650	67,060	65,950
Marine Divisions .	9	22,138	22,066	22,350	21,740	21,740	21,734	21,734
Naval Stores . .	10 I	1,172,700	1,320,000	1,347,000	1,429,300	1,544,500	1,421,000	1,377,000
Machinery and Ships built by Contract.	10 II	683,239	767,153	1,052,600	1,049,400	2,126,000	2,476,300	1,911,000
New Works, Buildings, &c.	11	550,141	561,853	471,250	491,065	668,500	630,653	560,325
Medicines and Medical Stores.	12	70,460	85,825	75,825	80,520	80,810	87,060	75,400
Martial Law, &c. .	13	10,069	9,973	10,400	10,400	10,000	9,400	11,500
Miscellaneous Services	14	127,421	155,786	151,005	181,716	149,311	148,260	191,125
Half-Pay, &c. . .	15	877,890	873,688	864,920	853,977	830,451	812,950	801,412
Military Pensions and Allowances.	16 I	847,035	869,177	876,950	889,641	905,250	905,871	906,8
Civil Pensions and Allowances.	16 II	337,991	330,965	330,180	328,903	330,795	333,801	329,33
		10,497,469	11,211,209	11,402,858	11,620,711	13,135,428	13,537,326	12,955,24
Army Department (Conveyance of Troops).	17	448,450	402,700	331,100	687,800	319,900	374,200	207,0
		10,945,919	11,613,909	11,733,958	12,308,511	13,455,328	13,911,526	13,162,2

In 1882–83 and subsequent years the amounts are shown in gross, including appropriations in aid.

MISCELLANEOUS TABLES AND PAPERS.

SHIPS OF THE BRITISH NAVY ON FOREIGN OR PARTICULAR SERVICE.

Mediterranean and Red Sea.

Agamemnon.
Albacore.
Alexandra.
Carysfort.
Cockatrice.
Colossus.
Cruizer.
Dolphin.
Dreadnought.
Falcon.
Gannet.
Grappler.
Hecla.
Hibernia.
Imogene.
Phæton.
Polyphemus.
Racer.
Scout.
Starling.
Surprise.
Thunderer.

Channel Squadron.

Agincourt.
*Curlew.
Iron Duke.
Minotaur.
Monarch.
Sultan.

North America and West Indies.

Bellerophon.
Bullfrog.
Canada.
Comus.
Emerald.
Forward.
Lily.
Mallard.
Pylades.
Terror.
Tourmaline.
Urgent.
Wrangler.

South East Coast of America.

Ready.†
Ruby.
Swallow.
Watchful.

Pacific.

Caroline.
Conquest.
Cormorant.
Hyacinth.
Liffey.
Pelican.
Triumph.
Wild Swan.

Cape of Good Hope and West Coast of Africa.

Acorn.
Alecto.
Flora.
Goshawk.
Icarus.
Landrail.
Raleigh.
Rifleman.
Royalist.

East Indies

Algerine.
Bacchante.
Garnet.
Griffon.
Kingfisher.
Mariner.
Osprey.
Penguin.
Ranger.
Reindeer.
Sphinx.
Turquoise.

China.

Alacrity.
Audacious.
Calliope.
Cockchafer.
Constance.
Cordelia.
Espoir.
Firebrand
Heroine.
Leander.
Linnet.
Merlin.
Mutine.
Orion.
Rattler.
Sapphire.
Satellite.
Swift.
VictorEmanuel.
Wanderer.
Wasp.

Australia.

Diamond.
Harrier.
Nelson.
Opal.
Rapid.
Raven.
Swinger.
Undine.

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* Curlew is temporarily attached to the Channel Squadron.

† Ready, when relieved by Flamingo, proceeds to North American Station.

SHIPS ON FOREIGN OR PARTICULAR SERVICE—*continued.*

TRAINING SQUADRON.

Active.
Calypso.
Rover.
Volage.

PARTICULAR SERVICE.

Assistance.
Daisy.
Hearty.
Himalaya.
Humber.
Jackal.
Mistletoe.
Orontes.
Seahorse.
Tamar.
Tyne.
Valorous.
Wye.

SURVEYING SERVICE.

Dart.
Egeria.
Myrmidon.
Paluma.
Rambler.
Sparrowhawk.
Sylvia.
Triton.

ORDERED HOME.

Daring.
Zephyr.

Stations of Her Majesty's Ships in Commission.

[WITH THE DATES AND PORTS OF COMMISSION CORRECTED UP TO NOVEMBER 5, 1887.]

ARMOURED SHIPS, CORVETTES, SLOOPS, AND GUN-VESSELS.

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned. When	Commissioned. Where.	Station.
Acorn	8	120	S. composite sloop	Com. W. E. B. Atkinson	Feb. 22, 1887	Devonport	Cape & W.C.of Africa.
Active	12	337	S. iron corvette	Capt. A. Markham	Sept. 21, 1885	Portsmouth	Training Squadron.
Agamemnon	6	400	D.S. turret ship	Capt. Cardale	Sept. 16, 1884	Plymouth	Mediterranean.
Agincourt	17	710	S. arm. ship	Capt. S. C. Holland (Rear-Admiral C. Rowley)	Re. Oct. 1, 1883	Devonport	Channel Squadron.
Ajax	6	400	D.S. turret ship	Capt. Durrant, C.M.G.	Aug. 5, 1885	Devonport	Greenock (C. G.).
Alacrity	4	94	D.S. steel desp. ves.	Com. R. B. Maconochie	June 22, 1886	Portsmouth	China.
Albacore	4	30	S. gunboat	Lt.-Com. F. G. Jones	Re. June 9, 1887	Malta	Mediterranean.
Alecto	4	68	P. vessel	Lt.-Com. George Izat	Re. Sept. 27, 1885	Cape Coast C'stle	Cape & W.C. of Africa
Alexandra	12	674	D.S. arm. ship	Capt. John Fellowes, C.B. (Admiral Duke of Edinburgh)	Re. Mar. 3, 1886	Malta	Mediterranean.
Algerine	4	79	S. gun-vessel	Com. W. C. C. Forsyth	Oct. 7, 1886	Sheerness	East Indies.
Audacious	10	490	D.S. arm. ship	Capt. R. H. Harris (V.-Ad. Sir R. V. Hamilton, K.C.B.)	Re. Jan. 7, 1886	Hong Kong	China.
Bacchante	14	424	S. iron corvette	Capt. A. W. Moore (R.-Ad. Sir F. Richards, K.C.B.)	April 14, 1885	Portsmouth	East Indies.
Banterer	4	59	S. gunboat	Lt.-Com. E. Hodgkinson	October 1, 1882	Devonport	Particular service.
Belleisle	4	188	D.S. arm. corvette	Capt. Guy O. Twiss	July 2, 1878	Chatham	Kingstown (C. G.).
Bellerophon	14	331	S. arm. ship	Capt. B. F. Clark (Vice-Ad. A. Mc. L. Lyons)	Dec. 15, 1885	Devonport	N. America & W. I.
Bramble	6	75	S. gunboat	Lieut. G. E. Harrison	Oct. 21, 1887	Devonport	Cape & W.C.of Africa.
Britomart	2	27	S. gunboat	Lt.-Com. H. J. Oldfield	October 1, 1882	Portsmouth	Particular service.
Bullfrog	4	60	S. gunboat	Lt.-Com. J. Masterman	Re. April 21, 1885	Bermuda	N. America & W. I.
Calliope	16	..	S. steel corvette	Capt. H. C. Kane	Jan. 25, 1887	Portsmouth	Australia.
Calypso	16	291	S. steel corvette	Capt. J. C. Burnell	Sept. 21, 1885	Chatham.	Training Squadron.
Canada	10	266	S. steel corvette	Capt. Lewis A. Beaumont	May 1, 1883	Portsmouth	N. America & W. I.
Caroline	14	161	S. corvette	Capt. Sir W. Wiseman, Bt.	January 27, 1886.	Sheerness	Pacific.

Extract from *Army and Navy Gazette*, November 5, 1887.

Stations of Her Majesty's Ships in Commission—*continued.*

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned. When.	Commissioned. Where.	Station.
Carysfort	14	252	S. steel corvette	Capt. A. E. Dupuis	Re. June 9, 1887.	Malta	Mediterranean.
Cockatrice	2	58	P. vessel	Com. W. Wilson	Re. Dec. 12, 1885	Malta	Danube.
Cockchafer	4	60	S. gunboat	Lt.-Com. H. H. Boteler	January 2, 1883	Devonport	China.
Colossus	9	325	D.S. turret ship	Capt. C. A. G. Bridge	April 13, 1886	Portsmouth	Mediterranean.
Comus	12	274	S. corvette	Capt. T. S. Jackson	April 6, 1886	Sheerness	N. America & W. I.
Conquest	14	285	S. steel corvette	Capt. C. L. Oxley	April 18, 1885	Devonport	Pacific.
Constance	14	265	S. steel corvette	Capt. L. C. Keppel.	Re. Jan. 17, 1886	Hong Kong	China.
Cordelia	10	..	S. steel corvette	Capt. Henry H. Boys	Jan. 25, 1887	Portsmouth	China.
Cormorant	6	123	S. sloop	Com. J. E. T. Nicolls	May 26, 1885	Portsmouth	Pacific.
Curlew	4	90	D.S. gun & torp. ves.	Com. Anthony Kingscote	June 22, 1886	Devonport	Channel squadron.
Daring	4	123	S. sloop	Com. A. H. Boldero	Re. Dec. 12, 1883	Hong Kong	Homeward bound.
Devastation	4	356	D.S. turret ship	Capt. F. S. Vander-Meulin	September 7, 1885	Portsmouth	Queensferry (C. G.).
Diamond	12	233	S. corvette	Capt. F. S. Clayton	Re. Jan. 14, 1885	Sydney	Australia.
Dolphin	4	113	S. sloop	Com. Hon. H. Lambton	May 1, 1884	Sheerness	Mediterranean.
Dreadnought	4	440	D.S. turret ship	Capt. H. F. Stephenson, C.B.	October 14, 1884	Portsmouth	Mediterranean.
Edinburgh	9	445	D.S. turret ship	Capt. H. B. Palliser	Aug. 27, 1887	Portsmouth	Mediterranean.
Emerald	12	222	S. corvette	Capt. R. H. Hamond	March 2, 1886	Pacific	N. America & W. I.
Espiegle	10	155	S. composite sloop	Com. Clarke	Aug. 23, 1887	Devonport	Pacific.
Espoir	4	60	S. gunboat	Lt.-Com. H. R. Adams	January 11, 1883	Devonport	China.
Falcon	3	100	S. gun-vessel	Com. E. Rooke	Re. Feb. 10, 1885	Malta	Mediterranean.
Firebrand	4	60	S. gunboat	Lt.-Com. Denison	May 6, 1884	Devonport	China.
Flamingo	4	100	S. gun-vessel	Com. H. C. Bigge	Aug. 23, 1887	Devonport	S. E. C. of America.
Forward	4	60	S. gunboat	Lt.-Com. J. E. Bearcroft.	Re. May 21, 1887	Bermuda	N. America & W. I.
Gannet	7	140	S. sloop	Com. B. R. Bradford	Sept. 3, 1885	Sheerness	Mediterranean.
Garnet	12	230	S. corvette	Capt. Jenkins	Aug. 23, 1887	Chatham.	East Indies.
Goshawk	4	60	S. gunboat	Lt.-Com. J. H. Pelly	Feb. 26, 1887	Bermuda	West Coast of Africa.
Grappler	4	60	S. gunboat	Lt.-Com. W. B. Charter	Re Feb. 18, 1885	Gibraltar	Mediterranean.
Griffon	5	100	S. gun-vessel	Com. J. E. Blaxland	March 16, 1887	Devonport	East Indies.
Hearty	4	60	P. vessel	Com. E. Chichester	Sept 7, 1886	Sheerness	Particular service.
Hecla	6	245	S. torp. depot ship	Capt. E. Jeffreys	Re. Oct. 1, 1885	Devonport	Mediterranean.
Hercules	14	357	S. arm. ship	Capt. C. E. Buckle (Vice Ad. J. K. E. Baird)	May 1, 1881	Portsmouth	Portland (C.G.).
Heroine	8	150	S. corvette	Capt. C. J. Balfour.	Sept 19, 1882	Devonport	China.
Hotspur	4	237	D.S. turret ram	Capt. James G. Mead	Re May 21, 1887	Portsmouth	Harwich (C.G.).

Hyacinth	8	161	S. corvette	Capt. E. G. Bourke	Jan. 27, 1886	Devonport	Pacific.
Icarus	8	122	S. sloop	Com. W. M. Annesley	July 6, 1886	Devonport	Cape & W.C. of Africa.
Invincible	14	490	D.S. arm. ship	Capt. C. G. Fane	Nov. 23, 1886	Devonport	Southampton (C.G.).
Iron Duke	14	440	D.S. arm. ship	Capt. R. H. Boyle	April 16, 1885	Devonport	Channel Squadron.
Jackal	2	60	P. vessel	Lt.-Com. A. M. Farquhar	May 1886	Devonport	Particular service.
Kingfisher	6	139	S. sloop	Com. R. B. Needham	Nov. 11, 1884	Sheerness	East Indies.
Landrail	4	93	D.S. gun & torp. ves.	Com. D. A. Crofton	March 10, 1887	Devonport	Cape & W.C. of Africa.
Leander	10	..	D.S. steel 2-cl. cruiser	Capt. M. J. Dunlop	May 29, 1885	Chatham	China.
Lily	3	..	S. gun-vessel	Com. H. W. S. Gibson	Sept. 25, 1884	Devonport	About to recommis'n.
Linnet	5	82	D.S. gun-vessel	Com. W. Marrack	Re. Jan. 7, 1886	Hong Kong	China.
Lizard	6	75	S. gunboat	Lieut. Alaric W. J. Portal	Oct. 18, 1887	Devonport	Australia.
Mallard	4	61	S. gunboat	Lt.-Com. E. J. Sanderson	Re. Nov. 15, 1884	Bermuda	N. America & W. I.
Mariner	8	112	S. sloop	Com. J. Durnford	March 19, 1885	Devonport	East Indies.
Merlin	4	61	S. gunboat	Lt.-Com. W. M. Maturin	July 27, 1886	Hong Kong	China.
Minotaur	17	709	S arm. ship	Capt. A. T. Bruce (V.-Ad. Sir W. Hewett, V.C.)	April 4, 1882	Portsmouth	Channel Squadron.
Mistletoe	4	22	S. gunboat	Com. O. P. Tudor	August 1, 1884	Portsmouth	Channel Islands.
Monarch	7	531	S. turret-ship	Capt. E. J. Church	Sept. 15, 1885	Chatham	Channel Squadron.
Mutine	10	139	S. sloop	Com. John H. Martin	April 7, 1887	Devonport	China.
Nelson	12	556	D.S. arm. ship	Capt. Tynte F. Hammill (Rear-Ad. H. Fairfax, C.B.)	Re Jan. 15, 1885	Sydney	Australia.
Neptune	6	..	S. turret-ship	Capt. F. G. Grant	May 21, 1887	Portsmouth	Holyhead (C.G.)
Opal	12	203	S. corvette	Capt. D. H. Bosanquet	October 27, 1886	Sydney	Australia.
Orion	4	272	D.S. arm. ship	Capt. T. H. Royse	April 27, 1885	Malta	China.
Orwell	2	41	S. gunboat	Lt.-Com. C. H. Cochran	Feb. 23, 1876	Devonport	Coast of Ireland.
Osprey	6	139	S. sloop	Com. C. E. Gissing	Sept. 19, 1882	Sheerness	East Indies.
Pelican	8	139	S. sloop	Com. R. W. Hope	April 3, 1884	Devonport	Pacific.
Penguin	7	138	S. sloop	Com. F. H. Haygarth	Jan. 27, 1886	Devonport	East Indies.
Phaeton	10	285	D.S. 2-cl. cruiser	Capt. W. H. C. St. Clair	April 20, 1886	Chatham	Mediterranean.
Polyphemus	..	132	D. steel torpedo-ram	Com. E. J. P. Gallwey	Feb. 16, 1882	Chatham	Mediterranean.
Pylades	14	151	S. corvette	Capt. E. N. Rolfe, C.B.	Aug. 17, 1886	Sheerness	N. America & W. I.
Racer	8	112	S. sloop	Com. Henry J. May	April 9, 1885	Devonport	Mediterranean.
Raleigh	24	555	S. iron frigate	Capt. Burges Watson (R.-Ad. Sir W. Hunt-Grubbe)	Feb. 24, 1885	Devonport	Cape & W. C. of Africa
Ranger	3	100	S. gun-vessel	Com. S. A. Johnson	Re. May 1, 1884	Suakim	Recommissioning.
Rapid	12	231	S. corvette	Capt. A. J. W. Musgrave	September 9, 1884	Devonport	Australia.
Rattler	6	..	S. gunboat	Lt.-Com. Maitland-Dougall	May 5, 1887	Sheerness	China.
Raven	4	60	S. gunboat	Lt.-Com. F. W. Wyley	Oct. 27, 1886	Sydney	Australia.
Ready	4	78	D.S. gun-vessel	Com. Frederick Echlin	July 17, 1884	Sheerness	Recommissioning.
Reindeer	6	170	S. sloop	Com. H. B. Lang	Dec. 4, 1884	Devonport	East Indies.

Extract from *Army and Navy Gazette*, November 5, 1887.

Stations of Her Majesty's Ships in Commission—*continued.*

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned.		Stations.
					When.	Where.	
Rifleman	4	75	D.S. gun-vessel	Lt.-Com. C. G. Prater	Sept. 4, 1885	Sheerness	Cape & W. C. of Africa
Rover	14	352	S. iron corvette	Capt. Gerard Noel	Sept. 21, 1885	Chatham	Training Squadron
Royalist	12	215	S. corvette	Capt. G. W. Hand	April 14, 1886	Devonport	Cape & W. C. of Africa
Ruby	12	203	S. corvette	Capt. W. R. Kennedy (Senior officer on station)	April 16, 1885	Sheerness	S. E. C. of America.
Rupert	4	237	D.S. turret ram	Capt. E. St. J. Garforth, C.B.	Aug. 27, 1885	Portsmouth	Hull (C.G.).
Sapphire	12	203	S. corvette	Capt. W. C. Karslake	Jan. 18, 1883	Devonport	China.
Satellite	8	159	S. corvette	Capt. A. H. Alington	April 24, 1883	Sheerness	China.
Scout	4	140	D.S. s. torp. cruiser.	Com. C. J. Conybeare	Oct. 28, 1886	Portsmouth	Mediterranean.
Shannon	9	342	S. arm. ship	Capt. F. R. Blackburne	Aug. 5, 1885	Portsmouth	Bantry (C.G.)
Sphinx	7	91	P. vessel	Com. W. L. Morrison	Re. Mar. 19, 1887	Bombay	East Indies.
Starling	4	60	S. gunboat	Lt.-Com. A. W. Paget	July 17, 1886	Malta	Mediterranean.
Sultan	12	632	S. arm. ship	Capt. Ernest Rice	April 20, 1882	Portsmouth	Channel Squadron.
Surprise	6	93	D.S. steel desp. ves.	Com. Hon. M. A. Bourke	July 20, 1886	Portsmouth	Mediterranean.
Swallow	8	112	D.S. sloop	Com. R. J. Fortescue	Oct. 7, 1886	Sheerness	S.E.Coast of America.
Swift	5	82	D.S. gun-vessel	Com. Arthur C. Bromley	Re. Aug. 15, 1884	Hong Kong	China.
Swinger	4	60	S. gunboat	Lt.-Com. A. C. Allen	Re. May 4, 1887	Sydney	Australia.
Temeraire	8	531	D.S. arm. bar. ship	Capt. E. C. Drummond	Re. Oct. 20, 1887	Portsmouth	Channel Squadron.
Thalia	8	..	S. corvette	Capt. J. R. E. Pattisson	Re. May 12, 1887	Devonport	Particular service.
Thunderer	4	400	D.S. turret ship	Capt. Walter Stewart	April 26, 1885	Malta	Mediterranean.
Tourmaline	12	208	S. corvette	Capt. Mather Byles	Aug. 15, 1886	Sheerness	N. America & W. I.
Triumph	14	531	S. arm. ship	Capt. Henry Rose (R.-Ad. A. C. F. Heneage	January 1, 1885	Portsmouth	Pacific.
Turquoise	12	231	S. corvette	Capt. R. Woodward, C.B.	May 20, 1884	Sheerness	Abt. to Recommission
Volage	12	347	S. iron corvette	Capt. C. Johnstone	Sept. 21, 1885	Portsmouth	Training Squadron.
Wanderer	4	100	S. sloop	Com. George A. Giffard	May 1, 1884	Sheerness	China.
Wasp	6	..	S. gunboat	Lt.-Com. B. J. H. Adamson	April 21, 1887	Sheerness	China
Watchful	4	60	S. gunboat	Lt.-Com. J. E. C. Goodrich	August 15, 1884	Devonport	S.E. Coast of America
Wild Swan	8	125	S. sloop	Com. J. S. Hallifax	January 22, 1885	Devonport	Pacific.
Wrangler	4	60	S. gunboat	Lt.-Com. H. D. Law	July 14, 1885	Devonport	N. America and W. I.
Zephyr	4	61	S. gunboat	Lt.-Com. C. K. Hope	Re. Dec. 12, 1883	Hong Kong	Homeward bound.

TROOP, TRANSPORT, SUPPLY, AND SURVEYING SHIPS.

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned.		Station.
					When.	Where.	
Assistance	2	132	S. troopship	Capt. A. K. Bickford, C.M.G.	Re. Feb. 1, 1879	Portsmouth	Particular service.
Crocodile	3	243	S. troopship	Capt. Richard Evans	February, 1884	Portsmouth	Indian troop service.
Dart	2	54	S. yacht	Lieut-Com. A. M. Field	Re. Nov. 15, 1885	Sydney	Australia (surveying)
Egeria	4	111	S. sloop	Capt. P. Aldrich	Oct. 14, 1886	Devonport	Surveying.
Euphrates	3	243	S. troopship	Capt. A. Paget	May 5, 1886	Portsmouth	Indian troop service.
Harrier	..	28	Schooner	Lt-Com. F. O. Pike	Re. Jan. 14, 1885	Sydney	Australia.
Himalaya	2	223	S. troopship	Capt. J. E. Stokes	December 7, 1882	Plymouth	Particular service.
Humber	1	85	Troop and storeship	Com. H. J. G. Garbett	January 1, 1885	Hull	Particular service.
Malabar	3	243	S. troopship	Capt. A. W. Fanshawe	Aug. 15, 1887	Portsmouth	Indian troop Service.
Myrmidon	4	111	S. gun-vessel	Com. R. F. Hoskyn	January 10, 1884	Sheerness	About to recommiss'n.
Orontes	2	225	S. troopship	Capt. C. B. Theobald	July 3, 1883	Chatham	Particular service.
Paluma	..	40	D.S. gunboat	Lt-Com. G. E. Richards	Owned by Queensland Government.		Colonial survey. serv.
Rambler	3	111	S. gun-vessel	Com. W. U. Moore	November 1884	Chatham	China, surveying.
Sea-horse	..	64	D.S. steel tug	Staff-Capt. G. J. Tomlin	January 20, 1881	Portsmouth	Particular service.
Serapis	3	243	S. troopship	Capt. F. R. Boardman, C.B.	Re. July 1, 1880	Portsmouth	Indian troop service.
Sparrowhawk	..	33	Schooner	Lieut-Com. A. Havergal	Re. Aug. 1, 1885	Bermuda	N. A. & W. I., survey.
Sylvia	4	111	S. gun-vessel	Com. L. S. Dawson	Dec. 12, 1885	Malta	Surveying.
Tamar	2	..	S. troopship	Capt. J. B. Warren	Oct. 21, 1882	Devonport	Particular service.
Triton	..	40	P. vessel	Staff-Com. T. H. Tizard	May 2, 1882	Sheerness	Surveying, Home Sta.
Tyne	2	135	S. troopship	Com. W. E. Darwell	June 18, 1878	Chatham	Particular service.
Undine	..	34	Schooner	Lt. Com. F. R. Pelly	Re. Jan. 14, 1885	Sydney	Australia.
Valorous	1	175	P. frigate	Capt. J. H. Bainbridge	November 1, 1882	Devonport	Particular service.
Wye	1	75	S. storeship	Staff-Com. A. Thomas	Re. Nov. 20, 1879	Sheerness	Particular service.

Extract from *Army and Navy Gazette*, November 5, 1887.

Stations of Her Majesty's Ships in Commission—*continued.*

TRAINING AND STATIONARY SHIPS, YACHTS, AND TENDERS.

Name.	Guns.	Men.	Class.	Commanding Officer.	Commissioned. When.	Commissioned. Where.	Stations.
Alberta	..	..	P. yacht	Staff-Com. W. B. Goldsmith	Tender to Vic	toria and Albert	Portsmouth.
Asia	4	271	Flagship	Capt. R. E. Tracey	Re. July 1, 1884	Portsmouth	Portsmouth.
				(Rear-Ad. J. O. Hopkins)			
Avon	4	28	D.S. gun-vessel	Lt.-Com. C. F. Foley	Tender to	Invincible	Southampton Water.
Boscawen	16	154	Boys' training-ship	Com. A. Schomberg	Re. Jan. 1, 1877	Portsmouth	Portland.
Brilliant	8	12	Drill-ship for R.N.R.	Lieut.-Com. E. S. Evans	Re. April 1, 1881	Inverness	Inverness.
Britannia	..	177	Nav. Cdts. Schl. S.	Capt. F. G. D. Bedford, C.B.	Re. April 1, 1880	Dartmouth	Dartmouth.
Cambridge	29	180	Gunnery-ship	Capt. H. F. Cleveland	Re. April 1, 1880	Devonport	Devonport.
Castor	13	30	Drill-ship for R.N.R.	Com. Henry N. Alleyne	Re. April 1, 1881	North Shields	North Shields.
Cherub	2	25	S. gunboat	Com. A. H. Lindesay	Tender to	Hercules	Portland
Clyde	15	30	Drill-ship for R.N.R.	Com. A. W. Warry	Re. April 1, 1881	Aberdeen	Aberdeen.
Cruiser	4	91	Sailing sloop	Com. Pigott	Re. Feb. 1, 1883	Malta	Mediterranean.
Dædalus	13	30	Drill-ship for R.N.R.	Com. C. H. Hawkins	Re. April 1, 1881	Bristol	Bristol
Defiance	..	..	Torp. school-ship	Com. J. Norcock	Com. Dec. 13, 1884	Devonport	Devonport.
Duke of Wellington.	25	273	Flagship	Capt. Seymour, C.B., A.D.C.	Jan. 1, 1883	Portsmouth	Portsmouth.
				(Admiral Sir G. O. Willes, K.C.B.)			
Duncan	31	191	Flagship	Capt. A. C. Curtis	Re. Jan. 1, 1882	Sheerness	Sheerness.
				(Vice-Adml. C. L. D.	Waddilove.)		
Durham	17	30	Drill-ship for R.N.R.	Com. Henry Washington	Re. April 1, 1881	Sunderland	Sunderland.
Eagle	12	31	Drill-ship for R.N.R.	Com. L. Ching	Re. April 1, 1881	Liverpool	Liverpool.
Elfin	..	..	P. yacht	Staff-Com. W. P. Haynes	Tender to Vic	toria and Albert.	Portsmouth.
Elk	4	28	D.S. gun-vessel	Lieut.-Com. F. L. Laurence	Tender to	Devastation	Queensferry.
Enchantress	1	59	P. yacht	Staff-Com. W. W. Vine	April 1, 1877	Portsmouth	Portsmouth.
Excellent	13	246	Gunnery-ship	Capt. C. E. Domvile	Re. July 1, 1884	Portsmouth	Portsmouth.
Firefly	4	25	S. gunboat	Lieut.-Com. G. H. Cherry	Tender to	Penelope	Harwich.
Fire Queen	..	22	S. yacht	Staff-Capt. J. Phillips	Tender to	D. of Wellington	Portsmouth.
Firm	4	28	S. gunboat	Lieut.-Com James Brant	Tender to	Devastation	Queensferry.
Flora	1	51	Storeship	Com. C. K. Kennedy-Purvis	Re. Oct. 1, 1881	C. of G. Hope	Simon's Bay.
Forester	4	30	S. gunboat	Lieut.-Com. A. Haggard	Tender to	Ajax	Greenock.
Foxhound	4	80	S. gunboat	Lt.-Com. S. H. Thompson	Tender to	Neptune.	Holyhead.
Ganges	19	139	Boys' training-ship	Com. Guy Mainwaring	Re. July 1, 1884	Devonport	Falmouth.
Handy	..	..	Gunboat	Lt.-Com. J. R. Jellicoe	Tender to	Excellent	Portsmouth.
Hibernia	12	122	Receiving ship	Com. H. H. Barnard	Re. July 1, 1881	Malta	Malta.
				(Rr.-Ad. R. Gordon-Douglas			
Imogene	..	22	S. yacht	Lieut.-Com. E. Duncombe	Re. Oct. 1, 1887	Cattaro	Mediterranean.
Impregnable	22	103	Boys' training-ship	Capt. H. G. Andoe, C.B.	Re. July 1, 1884	Devonport	Devonport.
Indus	1	300	Flagship	Capt. H. H. Rawson, C.B.	July 1, 1884	Devonport	Devonport.
				(Rear-Ad. H. D. Grant, C.B.)			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Lion	24	186	Boys' training-ship.	Com. Edmund S. Poë	Re. July 1, 1881	Devonport	Devonport.
Martin	10	27	Brig	Com. C. S. Nicholson	Tender to	St. Vincent	Portsmouth.
Nankin	..	39	Receiving ship.	Capt. G. D. Morant	Re. April 1, 1880	Pembroke	Pembroke Dock.
Nautilus	8	27	Brig	Lt.-Com. W. H. Somerset	Tender to	Impregnable	Devonport.
Osborne	2	145	P. royal yacht	Com. Hon. A. Curzon-Howe	April 1, 1883	Portsmouth	Portsmouth.
Pembroke	1	57	Flagship	Capt. Lord C. T. Scott, C.B. (Rear-Ad. Edward Kelly)	Re. July 1, 1884	Sheerness	Chatham.
Pilot	8	31	Brig	Lieut.-Com. A. W. Rogers	Tender to	Impregnable	Devonport.
President	10	32	Drill-ship for R.N.R.	Com. C. Caffin	Re. April, 1, 1881	West India Docks	West India Docks.
Revenge	28	203	Flagship	Capt. F. P. Doughty (Rear-Ad. Hon Carpenter)	Re July 1, 1876	Queenstown	Queenstown.
Royal Adelaide.	13	269	Flagship	Capt. Harry W. Brent (Ad. Lord J. Hay, G.C.B.)	Re. Jan. 1, 1881	Devonport	Devonport.
St. Vincent	22	172	Boys' training-ship	Com. Alvin C. Corry	Re. July 1, 1884	Portsmouth	Portsmouth.
Seaflower	8	27	Brig	Lieut.-Com. Rolleston	Tender to	Boscawen	Portland.
Sealark	8	27	Brig	Lieut.-Com. P. C. Underwood	Tender to	Ganges	Devonport.
Sprightly	2	23	P. vessel	Staff Com. H. E. Wood	Tender to	D. of Wellington	Portsmouth.
Terror	8	67	Receiving ship	Capt. R. P. Dennistoun	Re. Jan. 1, 1880	Bermuda.	Bermuda
Trent	3	23	D.S. gunboat	Lieut. C. H. P. Jones	Tender to	Duncan	Sheerness.
Trincomalee	15	33	Drill-ship for R.N.R.	Com. F. Edwards	Re. April 1, 1881	..	Southampton Water.
Unicorn	10	30	Drill-ship for R.N.R.	Com. W. H. G. Nowell	Re. April 1, 188[illegible]	Dundee	Dundee.
Urgent	3	101	Depot ship	Commodore H. Hand	Re. Oct 1, 1883	Jamaica	Jamaica.
Vernon	..	202	Torpedo school ship	Capt. Samuel Long	Re. Jan. 1, 1884	Portsmouth	Portsmouth.
Vesuvius	..	..	D.S. torpedo vessel	Lieut.-Com. H. B. Jackson	Tender to	Vernon	Portsmouth.
Victor Emanuel	2	141	Receiving ship	Commodore W. Maxwell.	Re. Feb. 1884	Malta	Hong Kong.
Victoria & Albert	2	151	P. royal yacht	Capt. J. R. Fullerton	Re July 1, 1880	Portsmouth	Portsmouth.
Victory	26	52	—	—	—	—	Portsmouth.
Vivid	1	23	P. vessel	Staff-Com. T. Roberson	Tender to	Royal Adelaide	Devonport.
Wave	..	..	S. yacht	Lieut.-Com. W. L. Bignold	Tender to	Britannia	Dartmouth.

Stations of the Royal Marine Forces.

Division.	No. Cos.	Commanding Officer.	Second in Command.	Station.
Artillery	16	Col. H. B. Tuson, C.B., A.D.C.	Col. J. F. Crease, C.B.	Eastney, near Portsmouth.
Light Infantry—				
Chatham	16	Col. G. F. Munroe	Col. J. M. Moody	Chatham.
Portsmouth	16	Col. A. H. F. Barnes	Col. M. A. H. J.Heriot	Forton Barracks, Gosport.
Plymouth	16	Col. A. H. H. Walsh	Col. P. R. Holmes	Plymouth.
Depot—Walmer	4	Col. J. Cairncross		Walmer.

Extract from *Army and Navy Gazette*, November 5, 1887.

PARLIAMENTARY PAPER.

Dockyard Expense Accounts.

SHIPBUILDING AND DOCKYARD TRANSACTIONS FOR THE YEAR 1885–86.

REPORT of the ACCOUNTANT-GENERAL of the NAVY.

Admiralty, S.W., 18 *March*, 1887.

I BEG leave to submit herewith the Dockyard Expense Account for the year 1885–86, and in accordance with previous practice, to direct attention to the general result of Shipbuilding and Dockyard expenditure for that year.

Upon armoured construction the total amount spent was:—

	£
On contract-built ships	887,281
On dockyard ,,	990,833
Total	£1,878,114

Out of the above sums the following expenditure was incurred upon new armoured ships which were laid down in the course of the year 1885–86, namely:—

As regards contract-built vessels there was spent—

	£
Upon the Australia the sum of	94,137
,, Galatea ,,	94,370
,, Narcissus ,,	73,864
,, Orlando ,,	97,302
,, Renown ,,	141,490
,, Sans Pareil ,,	106,895
,, Undaunted ,,	65,794
7	£673,852

being 76 per cent. of the total amount spent upon armoured construction by private firms.

As regards dockyard-built vessels, there was spent—

	£
Upon the Aurora the sum of	12,890
„ Immortalité „	20,383
„ Nile „	6,716
„ Trafalgar „	13,335
4	£53,324

Thus the total amount spent on armoured ships laid down in the year was £727,176.

Upon unarmoured construction the total amount spent was—

——	Dockyard.	Contract.	Total.
	£	£	£
Protected ships	334,379	—	334,379
Partially protected	71,550	48,518	120,068
Unprotected ships and torpedo boats . .	203,208	1,179,022	1,382,230
Tugs, yard craft, &c.	4,648	18,022	22,670
Total	£613,785	1,245,562	1,859,347

This, added to the total expenditure upon armoured construction, gives a final total amount spent during the year on actual new construction of £3,737,461.

Upon unarmoured ships laid down in the course of the year:—

At private yards, there was spent—

	£
Upon the Bramble the sum of	9,962
„ Lizard „	11,381
„ Rattler „	16,099
„ Rattlesnake „	4,755
„ Wasp „	13,022
5	£55,219

At the Royal Dockyards there was spent—

	£
Upon the Buzzard the sum of	6,632
„ Grasshopper „	469
„ Racoon „	7,604
„ Sandfly „	1,599
„ Serpent „	10,098
„ Spider „	1,839
6	£28,241

In drawing attention to these figures, it should be observed that the circumstances attending the shipbuilding arrangements in

1885–86 were of an altogether exceptional nature, both in regard to the sums spent and the progress made with new construction.

The following Table illustrates the continuous and progressive increase of expenditure on naval construction during the last seven years:—

Year.	Dockyard.	Contract.	Machinery.	Total.
	£	£	£	£
1880–81 . . .	891,388	235,920	299,041	1,426,349
1881–82 . . .	1,149,718	292,243	240,539	1,682,500
1882–83 . . .	1,173,816	301,159	292,039	1,767,014
1883–84 . . .	1,186,793	235,913	507,384	1,930,090
1884–85 . . .	1,333,607	449,421	459,042	2,242,070
1885–86 . . .	1,183,588	1,550,362	1,003,511	3,737,461
1886–87*. . .	*1,479,927*	*1,430,200*	*746,000*	*3,656,127*
1887–88*. . .	*1,473,552*	*1,016,753*	*567,950*	*3,058,255*

* Estimated, as shown in the programme of construction in the Estimates.
Note.—Increases in Roman figures. Decreases in *Italic* figures.

The amount spent during the year on the repairs and maintenance of the fleet was £988,641, and the expenditure for the past seven years is as follows:—

Year.	Ships.	Hulks.	Tugs, &c.	Total.
	£	£	£	£
1879–80 . . .	781,231	10,127	43,679	835,037
1880–81 . . .	791,033	9,576	45,363	845,972
1881–82 . . .	682,813	6,130	33,930	722,873
1882–83 . . .	843,132	6,574	32,104	881,810
1883–84 . . .	873,866	7,714	47,656	929,236
1884–85 . . .	972,605	7,456	35,737	1,015,798
1885–86 . . .	946,890	7,556	34,195	988,641

As an explanation of the actual expenditure under this head on individual ships, the following Table may be found instructive:—

PRINCIPAL COST of the REPAIRS and ALTERATIONS of ARMOURED VESSELS, since 1879–80.

SHIP.	1879–80.	1880–81.	1881–82.	1882–83.	1883–84.	1884–85.	1885–86.	Total.
	£	£	£	£	£	£	£	£
Hotspur	51,790	48,729	5,361	7,252	867	686	6,188	120,873
Devastation	46,291	3,737	1,187	2,929	1,264	2,087	14,741	72,236
Sultan	41,513	12,386	8,025	4,597	1,698	6,861	13,596	88,676
Swiftsure	24,974	23,894	10,435	1,824	120	1,494	*2,813*	59,928
Audacious	16,001	12,340	32,801	39,947	787	3,644	6,309	111,829
Bellerophon	714	28,935	13,259	5,088	11,340	15,893	56,317	131,546
Minotaur	4,787	6,520	23,168	8,286	2,029	15,031	5,329	65,150
Monarch	1,764	3,197	8,821	*259*	4,655	1,512	24,705	44,395
Achilles	2,068	13,056	4,998	9,183	4,966	8,650	*5,941*	36,980
Alexandra	2,957	2,583	1,982	15,261	3,891	9,324	14,074	50,072
Shannon	48	90	*4,433*	34,321	3,446	2,616	5,176	41,264
Rupert	678	*2,684*	292	30,014	4,497	1,031	7,570	41,398
Agincourt	3,530	3,742	4,407	12,081	2,700	11,286	7,447	45,193
Black Prince	23,260	*579*	*697*	*935*	238	43,834	19,534	84,655
Triumph	3	25	129	186	35,170	28,997	3,271	67,781
Iron Duke	2,613	6,092	1,546	*1,879*	57,375	13,862	6,114	85,723
Polyphemus	—	—	5	10,911	7,168	16,631	7,463	42,178
Temémaire	1,818	1,761	992	2,227	869	23,003	6,835	37,505
Invincible	2,368	1,386	3,904	3,047	1,165	15,398	5,484	32,752
Belleisle	1,570	885	4,306	862	2,441	2,823	4,433	17,320
Hector	2,157	2,866	1,302	2,549	1,745	2,993	3,394	17,006
Hydra	580	1,168	1,729	1,214	1,090	*99*	5,338	11,020
Neptune	2,246	*724*	602	3,484	2,516	5,635	10,110	23,869
Agamemnon	—	—	—	—	977	4,993	4,495	10,465
Dreadnought	3,595	2,949	3,459	4,268	2,011	10,031	13,012	39,325
Hercules	1,518	1,923	2,869	3,725	2,768	5,409	8,981	27,193
Inflexible	7	81	4,018	5,263	7,622	*1,525*	27,567	43,033
Penelope	1,531	1,531	1,848	5,871	149	3,959	7,455	22,344
Total. £	240,381	175,889	136,315	211,317	165,564	256,059	286,184	1,471,709

A comparison between the total effective Votes for naval services and the total of the productive Dockyard Votes 6 and 10 for the last seven years gives the following result:—

YEAR.	Total Effective Votes.	Total Votes. 6 and 10.	Percentage.
	£	£	
1879–80	8,194,436	3,106,563	38
1880–81	8,050,900	3,082,803	38
1881–82	8,361,505	3,318,555	39
1882–83	8,590,499	3,472,953	40
1883–84	8,435,820	3,615,264	43
1884–85	8,833,350	3,861,334	44
1885–86	*12,682,123	*7,188,536	57

* Inclusive of Vote of Credit.

The increase in the year 1885–86 may of course be regarded as exceptional, and attributable to special causes indicated by the Vote of Credit granted that year.

The expenditure upon incidental charges shows an increase during the year, both actual and proportional, as is indicated by the following table:—

YEAR.	Expenditure on Ships.			Incidental Charges.	Percentage of Incidentals on direct Charges to Ships as at present cast.
	Dockyard Construction.	Repair.	Total.		
	£	£	£	£	
1879–80 . .	892,403	822,220	1,714,623	529,493	31
1880–81 . .	957,492	841,710	1,799,202	522,933	29
1881–82 . .	1,280,873	691,080	1,971,953	513,773	26
1882–83 . .	1,342,161	877,697	2,219,858	524,948	24
1883–84 . .	1,563,884	926,179	2,490,063	549,442	22
1884–85 . .	1,711,477	1,014,813	2,726,290	572,402	21
1885–86 . .	1,604,618	986,893	2,591,511	593,891	23

G. FITZGERALD.
Accountant-General of the Navy.

STATEMENT showing the Approximate Value of LAND and BUILDINGS in HER MAJESTY'S DOCKYARDS and NAVAL YARDS at HOME and ABROAD on the 28th February, 1887.

—	Land.		Buildings.	
	Amount.	Total.	Amount.	Total.
	£	£	£	£
DOCKYARDS AT HOME—				
Portsmouth	130,850		3,947,000	
Devonport	89,800		2,575,000	
Chatham	253,330		2,458,000	
Sheerness	4,525		888,000	
Pembroke	3,110		646,000	
Haulbowline	1,450	483,065	609,000	11,123,000
NAVAL YARDS ABROAD—				
Antigua	90		32,000	
Bermuda	6,138		461,100	
Cape of Good Hope	14,000		44,300	
Esquimalt	1,200		21,500	
Gibraltar	56,000		103,000	
Halifax	19,600		66,300	
Hong Kong	3,375		32,600	
Jamaica	2,500		14,800	
Kowloon	1,187		32,000	
Malta	50,017		548,000	
Trincomalee	300		31,700	
		154,407		1,387,300
		£637,472		£12,510,300

STATEMENT showing the Value of NAVAL STORES and COALS in Stock in HER MAJESTY'S NAVAL ESTABLISHMENTS at HOME and ABROAD (actual on 31st March, 1886, and Estimated on 31st March, 1887).

—	Home Dockyards.	Naval Yards Abroad.	Total.
VALUE OF NAVAL STORES, &c.—	£	£	£
On 31st March, 1886 (actual)	2,142,000	679,000	2,821,000
On 31st March, 1887 (estimated)	1,900,000	660,000	2,560,000

STATEMENT showing the COST of CONSTRUCTION, REPAIRS and MAINTENANCE, and by CONTRACT during the Years

YEAR.	TONS BUILT (WEIGHT OF HULL).					EXPENDITURE FOR LABOUR AND				
	DOCKYARD.		CONTRACT.			CONSTRUCTION.				
						Dockyard-built Vessels.		Contract-built Vessels.		
	Armoured.	Unarmoured.	Armoured.	Unarmoured.	TOTAL.	Armoured.	Unarmoured.	Armoured.	Unarmoured.	TOTAL.
1869–70	10,632	2,994	10,828	719	25,173	536,293	259,906	540,055	50,793	1,387,047
1870–71	9,567	3,942	6,395	627	20,531	558,800	264,052	455,415	52,547	1,330,814
1871–72	6,261	7,167	7,659	371	21,458	345,750	448,074	349,288	41,060	1,184,172
1872–73	5,789	6,632	564	1,546	14,531	237,956	413,878	61,869	95,384	809,087
1873–74	5,003	6,317	—	3,384	14,704	377,715	615,128	8,244	288,941	1,290,028
1874–75	7,916	3,388	541	4,635	16,480	710,236	372,023	31,928	413,974	1,528,161
1875–76	10,641	3,516	3,635	1,924	19,716	759,495	289,606	298,968	265,149	1,613,218
1876–77	7,920	5,517	3,528	7,265	24,230	604,607	497,506	335,711	684,136	2,121,960
1877–78*	5,940	6,112	1,173	3,338	16,563	408,433	421,897	1,540,039	552,073	2,922,442
1878–79	6,912	4,759	1,518	4,743	17,932	372,679	353,504	258,516	523,350	1,508,049
1879–80	7,189	5,215	238	2,585	15,227	528,471	363,932	103,253	392,951	1,388,607
1880–81	9,235	4,233	—	3,353	16,821	648,017	309,475	50,781	418,076	1,426,349
1881–82	10,748	4,690	—	3,172	18,610	938,641	342,232	10,672	390,955	1,682,500
1882–83	11,372	4,763	192	3,590	19,917	961,151	381,010	29,559	395,294	1,767,014
1883–84	11,714	4,644	1,222	1,771	19,351	1,127,377	436,507	132,760	233,446	1,930,090
1884–85	10,704	5,475	2,218	2,040	20,437	1,283,899	427,578	233,828	296,765	2,242,070
1885–86	—	—	—	—	—	990,833	613,785	887,281	1,245,562	3,737,461

* The number of tons built by contract in this year does not include 14,808 tons of armoured, and 4839 of unarmoured vessels, purchased out of the Vote of Credit; but their cost is included in the sums £1,540,039, and £552,073, under the head of expenditure on contract construction for this year.

and INCIDENTAL CHARGES, also TONS (Weight of Hull) built in DOCKYARDS 1869–70 to 1885–86 inclusive.

MATERIALS ON			TOTAL EXPENDITURE ON SHIPS.			TOTAL AMOUNT EXPENDED UNDER VOTE.	
REPAIR AND MAINTENANCE.							
Armoured.	Unarmoured.	TOTAL.	Direct — For Labour and Materials, including Payments to Contractors, &c.	Indirect — For Dockyard Incidental Charges.	TOTAL.	Votes 6 and 10, for Labour and Stores, &c.	Navy Votes, Net.
180,743	446,549	577,292	1,964,839	491,104†	2,455,443	2,572,745	10,102,641
182,065	487,551	669,616	2,000,430	499,902†	2,500,332	2,635,076	10,087,414
87,595	397,342	484,937	1,669,109	436,102	2,105,211	2,545,865	9,875,981
158,933	386,983	545,916	1,355,003	416,888	1,771,891	2,413,347	9,564,678
291,381	524,601	815,982	2,106,010	483,398	2,589,408	3,175,631	10,558,751
320,229	672,570	992,799	2,520,960	490,419	3,011,379	3,455,650	10,776,277
321,871	631,806	953,677	2,566,895	530,179	3,097,074	3,540,092	10,903,924
207,446	600,210	807,656	2,929,616	509,973	3,439,589	3,929,846	11,259,835
489,182	580,243	1,069,425	3,991,867	521,034	4,512,901	5,123,591	12,800,044
430,077	634,074	1,064,151	2,572,200	566,516	3,138,716	3,810,737	11,959,139
331,033	491,187	822,220	2,210,827	529,493	2,740,320	3,106,563	11,004,394
259,987	581,723	841,710	2,268,059	522,933	2,790,992	3,082,803	10,518,469
212,288	478,792	691,080	2,373,580	513,773	2,887,353	3,318,555	10,870,922
321,979	555,718	877,697	2,644,711	524,948	3,169,659	3,472,953	12,063,210
266,497	659,682	926,179	2,856,269	519,442	3,405,711	3,615,264	10,758,594
328,270	686,543	1,014,813	3,256,883	572,402	3,829,285	3,861,333	11,625,809
335,222	651,671	1,691,019‡	5,428,480	593,891	6,022,371	7,188,536	16,193,701§

† These amounts are based upon the average indirect expenses for 1871–72 and 1872-73.
‡ Includes £703,126 for hire and fitting out of armed cruisers, &c.
§ Including Vote of Credit.
Note.—The method of measuring progress on ships by tons has now been abandoned.

EXPENSES INCURRED on behalf of VESSELS taken up by the ADMIRALTY as ARMED CRUISERS, COLLIERS, &c., on account of War Preparations.

Note.—The Figures printed in *Italics* show the Amount of Net Credits for Stores, &c., returned.

NAME OF SHIP.	EXPENDITURE INCURRED AND BROUGHT TO ACCOUNT IN THE YEAR 1885–86.												
	HULL.			MACHINERY.			OTHER FITTINGS, STORES, &C.			TOTAL.			
	Materials (Net).	Labour.	Contract Work, &c.	Materials (Net).	Labour.	Contract Work, &c.	Materials (Net).	Labour.	Contract Work, &c.	Materials (Net).	Labour.	*Contract Work, &c.	Total.
	£	£	£	£	£	£	£	£	£	£	£	£	£
Africa	..	..	1,251	..	..	..	..	..	..	..	..	1,251	1,251
Alaska	*5*	..	42,426	..	..	..	375	8	..	370	8	42,426	42,804
America	..	..	36,844	..	..	..	1,934	11	..	1,934	11	36,844	38,789
Arizona	1	..	28,471	..	..	..	399	16	..	400	16	28,471	28,887
Britannia	..	2	37,866	..	..	..	..	..	12	..	2	37,878	37,880
Coptic	..	..	35,823	..	..	..	..	..	..	..	..	35,823	35,823
Dauntless	..	..	1,279	..	..	..	..	..	..	..	..	1,279	1,279
Dynamic	..	..	7,803	..	..	..	..	..	..	..	..	7,803	7,803
Energia	..	..	5,800	..	..	..	..	..	..	..	..	5,800	5,800
Etruria	..	..	15,000	..	..	..	..	..	..	..	..	15,000	15,000
Flying Hurricane	..	..	1,272	..	..	..	..	..	..	..	..	1,272	1,272
Flying Kestrel	..	..	1,571	..	..	..	..	..	..	..	..	1,571	1,571
Galvanic	..	..	2,585	..	..	..	..	..	..	..	..	2,585	2,585
Ghazee	..	..	5,184	..	..	..	..	..	..	..	..	5,184	5,184
Gipsy	..	..	967	..	..	..	..	..	..	..	..	967	967
Glengoil	..	..	12,180	..	..	..	..	..	..	..	..	12,180	12,180
Glenogle	466	503	27,243	5	5	..	39	1	..	510	509	27,243	28,262
Hankow	..	..	8,196	..	..	..	..	..	..	..	..	8,196	8,196
India	405	378	29,505	9	6	..	16	..	..	430	384	29,505	30,319
Kimberley	..	..	19,503	..	..	..	..	..	..	..	..	19,503	19,503
Lusitania	251	13	34,923	..	..	..	83	..	..	334	13	34,923	35,270
Massilia	271	17	52,769	..	..	..	119	..	..	390	17	52,769	53,176
Merionethshire	..	..	5,384	..	..	..	..	..	..	..	..	5,384	5,384
Mexican	..	106	21,164	4	20	..	..	4	..	4	130	21,164	21,298
Moor	159	433	18,658	2	23	..	306	4	84	467	460	18,742	19,669
Moray	..	..	3,333	..	..	..	..	..	..	..	..	3,333	3,333
Oregon	303	195	56,131	..	..	..	1,482	48	..	1,785	243	56,131	58,159
Pembroke Castle	241	271	22,490	2	2	..	1,292	1	..	1,535	274	22,490	24,299
Recovery	..	..	3,100	..	..	..	..	..	..	..	..	3,100	3,100
Richmond Hill	..	..	15,669	..	..	..	..	..	..	..	..	15,669	15,669
River Indus	..	..	5,530	..	..	..	..	..	..	..	..	5,530	5,530
Rosetta	134	199	31,219	3	3	..	*7*	..	..	130	202	31,219	31,551
Scythian	..	..	1,287	..	..	..	..	..	..	..	..	1,287	1,287
State of Nebraska	..	..	25,484	..	..	..	..	..	..	..	..	25,484	25,484
Stirling Castle	..	..	22,122	..	..	..	..	..	..	..	..	22,122	22,122
Thales	..	..	3,820	..	..	..	..	..	..	..	..	3,820	3,820
Umbria	..	..	47,261	..	..	..	1,605	22	..	1,605	22	47,261	48,888
Weathercock	..	2	729	..	1	..	..	..	..	..	3	729	732
Total . . £	2,226	2,119	691,842	25	60	..	7,643	115	96	9,894	2,294	691,938	704,126
Incidental and Establishment Charges . . . . . . £													8,543
Total Expense, including Incidental and Establishment Charges £													712,669

* Includes, besides the cost of fitting out, &c., the whole cost of the hire and other expenses of the ship paid to the owners, and of the coals supplied for steaming.

A STATEMENT showing the AMOUNTS brought to Account between the 1st April, 1885, and 31st March, 1886, for HER MAJESTY'S SHIPS and VESSELS SOLD.

Name of Ship.	Purchase Money received for Old and Unserviceable Ships, sold out of the Service.			Remarks.
	£	s.	d.	
Sirius	4,308	0	7	
Dublin	1,876	2	1	
Laurel	1,151	18	5	
Swallow	225	0	0	Annual instalment.
Galatea	178	10	7	
Caledonia	6,500	0	0	
Royal Oak	6,500	0	0	
Zealous	6,000	0	0	
Pallas	6,250	0	0	
Favourite	3,500	0	0	
Hastings	3,300	0	0	
Dryad	2,000	0	0	
Magpie	1,650	0	0	
Vulture	1,650	0	0	
Plover	1,650	0	0	
Cromer	750	0	0	
Netley	750	0	0	
Joseph Straker	1,000	0	0	
Druid	3,600	0	0	
Atlas	8,400	0	0	
Endymion	6,500	0	0	
Flora	300	0	0	
Steam Launch, No. 14	39	1	0	
„ „ No. 30	23	17	0	
„ „ No. 32	29	12	0	
Steam Cutter, No. 6	109	12	5	
Decoy	725	0	0	
Total	£68,966	14	1	

RETURN of all GUNS of the Calibre of 64 pounds and over Supplied to the NAVY between the Years 1870 and 1886 inclusive, showing the Price of each Gun when Issued, and Condition of each Gun when Returned.

(The guns dealt with in this Return consist alone of such as have been actually placed on board ship. Guns appropriated to Navy either for armaments, or for reserve, which have not been actually placed on board ship, are not included.)

NATURE.	ISSUED TO ROYAL NAVY (not including Re-issues)			Average Cost per Gun.	RETURNED FROM ROYAL NAVY BETWEEN 1ST JANUARY 1870 AND 31ST DECEMBER 1886.													
					Number of Guns.			Actual Number of Returns into Store.			Sentence on Condition of Guns when Returned.							
					Of those Issued			Of those Issued				Repairable for						
	And on board Ship 31st Dec. 1869.	Between 1st Jan. 1870 and 31st Dec. 1886.	TOTAL. (a)		Prior to 31st Dec. 1869.	Between 1st Jan. 1870 and 31st Dec. 1886.	TOTAL. (b)	Prior to 31st Dec. 1869.	Between 1st Jan. 1870 and 31st Dec. 1886.	TOTAL. (c)	Serviceable.	Minor Repairs. (d)	New A Tubes.	New Cups.	New Muzzle-ends.	Trunnion Arm broken.	New Hoops, Coils, or B Tubes.	Unserviceable.
				£														
R.M.L., 64-pr. 64 cwt. . .	433	330	763	294	414	220	634	924	270	1,194	547	398	246	..	..	..	..	3
R.M.L., 64-pr. 71 cwt. (f) .	140	486	626	(g) 121	140	401	541	153	430	583	371	161	32	10	..	..	..	9
7-inch 90 cwt. . .	..	163	163	(e) 437 215	..	108	108	..	124	124	81	43	..	..	..	..	..	..
7-inch 6½ tons . .	505	48	553	575	481	39	52C	648	41	689	382	300	3	..	1	1	2	..
8-inch, 9 tons . .	101	27	128	738	98	20	118	140	20	160	91	64	5	..	..	..	..	..
9-inch, 12 tons . .	121	117	238	880	93	81	174	144	108	252	110	118	27	..	..	..	2	..
10-inch, 18 tons . .	11	106	117	1,141	11	39	50	20	47	67	26	25	14	..	2	..	..	..
11-inch, 25 tons . .	..	8	8	1,892	..	1	1	..	1	1	..	..	..	..	1	..	..	..
12-inch 25 tons . .	8	14	22	2,105	4	1	5	4	1	5	..	5	..	..	..	..	..	..
12-inch 35 tons . .	..	7	7	2,231	..	5	5	..	5	5	4	1	..	..	..	..	..	..

12·5-inch, 38 tons	..	21	21	3,199	..	4	4	..	4	4	..	3	..	..	..	..	..	*1
16-inch, 80 tons	..	5	5	9,811	..	1	1	..	1	1	..	..	1	..	..	..	..	..
R.B.L., 7-inch, 82 cwt.	75	..	75	511	75	..	75	75	..	75	38	19	17	..	..	..	..	1
B.L., 6-inch, 80-pr.	..	15	15	650	..	1	1	..	1	1	..	1	..	..	..	..	..	..
6-inch	..	267	267	816	..	48	48	..	48	48	42	4	2	..	..	..	..	..
8-inch	..	13	13	2,161	..	..	..	..	..	..	..	..	..	..	..	..	..	..
9·2-inch	..	7	7	4,793	..	4	4	..	4	4	4	..	..	..	..	..	..	..
12-inch	..	21	21	7,199	..	11	11	..	11	11	10	..	..	..	1	..	..	..
S.B., 100 pr.	38	..	38	725	11	..	11	11	..	11	9	2	..	..	..	..	..	..
TOTAL	1,432	1,655	3,087	..	1,327	984	2,311	2,119	1,116	3,235	1,715	1,139	347	10	5	1	4	14

* 12-inch calibre.

NOTES.

(*a*), (*b*) The difference between "(*a*)" and "(*b*)" shows the number of guns that have not been returned since first issue to ships.

(*b*), (*c*) The difference between the numbers shown in columns "(*b*)" and "(*c*)," respectively, arises from the circumstance that many individual guns have been returned to store, repaired, and re-issued, several times. The following details, relating to one gun, will exemplify this:—

Nature.	Returned from H.M.S.	Date.	Total Rounds Fired at Time of Return.	Sentence on Condition of Gun when Returned.
64-pr., 64 cwt., No. 156	SATELLITE	30 December, 1870	52	Serviceable.
	SWIFTSURE	14 October, 1878	79	Repairable for Re-venting.
	BRUISER	31 December ,,	784	New A tube.
	SABRINA	8 June, 1881	2,072	Through venting.
	,,	20 March, 1882	2,584	New A tube.

(*d*) Such as re-venting, filing grooves, coil-marks hammered up, new vent-plugs, re-coppering B.L., re-bushing R.B.L., &c.

(*e*) 135 of these guns were converted from 7-inch R.M.L. 6½-ton guns; cost of conversion averaged £214 16*s.* 10¾*d.* per gun. The remaining 23 were new guns, which cost on an average £437 6*s.* each.

(*f*) Converted from smooth-bore cast-iron guns, by being lined with wrought-iron on Sir William Palliser's system, and rifled.

(*g*) Cost of conversion only.

Parliamentary Paper No, 167.
9 *May*, 1887.

H. J. ALDERSON, Major-General,
Director of Artillery and Stores.

E. MAITLAND, Colonel, R.A.,
Superintendent Royal Gun Factory, Woolwich.

HEALTH OF THE NAVY.

REPORT FOR THE YEAR 1885. (Last report presented to Parliament.) *

SIR,—I have the honour to submit the Statistical Report of the Health of the Navy for 1885.

The Returns for the Total Force disclose what must be considered a satisfactory condition: the yearly ratios of sickness, invaliding, and deaths are substantially less than those of the preceding year, and not only have the increases which that year exhibited, disappeared, but, beyond this, reductions are shown in comparison with the averages of late years in nearly every instance.

While the general sanitary state of the Force was so satisfactory, there were outbreaks of enteric fever on several of the Stations, which, though limited in extent, caused considerable sickness and loss of life, from causes which must be classed as preventible. The too late recognition of impure water appears, as usual, to have been the origin in most of the cases; and too much reliance on chemical tests, instead of inquiries as to the source of the water-supply, is probably often the mistake made.

On the Home Station a reduction in the amount of venereal disease compared with 1884 has again been manifest, though the ratios remain far in excess of those experienced during the last years of the enforcement of the Contagious Diseases Acts. The last year's reduction in what appears to be the concurrent disease, scabies, has again turned into a considerable increase.

The Mediterranean Station shows a slightly higher sick rate than in 1884. The chief feature in its medical history was a serious outbreak of enteric fever in the ships at Malta towards the end of the year, the particulars of which are given in the details of the Station. The system of water-storage at Malta seems to have been very unsatisfactory.

On the North American and West Indian Station another visitation of yellow fever has to be recorded. It was confined to Port Royal, Jamaica, and appears to have been limited by the active measures taken to prevent its spread. Four deaths were caused by it.

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* Parliamentary Paper No. 41.

The South-East Coast of America Station shows a slightly increased sick rate, due to some cases of enteric fever, contracted apparently at the Falkland Islands.

There has been less malarial fever in the West Coast of Africa Squadron than in either of the last two years; no prolonged river expeditions took place there in 1885.

The East Indies Station also shows less malarial fever than of late; but eight fatal cases of cholera are reported, of which four were in the Expeditionary Force in Burmah.

On the China Station a disastrous outbreak of enteric and typho-malarial fevers, at Japan, is recorded; twelve persons in two ships were attacked; of these, ten were officers, of whom four died. The mortality from cholera was the same as in 1884, viz., four.

Eighty cases of injury in action, of which twenty-six were fatal, occurred in the Irregular Force; forty-two, with seventeen deaths, being in the Nile Expedition, and thirty-eight, with nine fatalities, occurred amongst the Marine Battalion in the Soudan at the action of the 22nd of March near Suakim.

The waste by invaliding from the whole Service is shown this year for the first time, and will be continued in these Reports. The heading "invalided," which has hitherto alone appeared, also includes those persons temporarily sent home from foreign stations for the re-establishment of their health, many of whom again join the Active Force. This year's ratio of the final waste will probably be found to bear about its normal proportion to the total invaliding rate.

The next year's Health Report must necessarily embody many important changes in classification, owing to the issue of the new Nomenclature of Diseases by the College of Physicians in 1884, so that some useful comparisons with former years will be for the future rendered difficult.

I have the honour to be, Sir,
Your most obedient Servant,
WILLIAM H. LLOYD, M.D.,
Deputy Inspector General
of Hospitals and Fleets.

Admiralty, Avenue House, Northumberland Avenue.

The Total Force in the service afloat, corrected for time, in the year 1885, was 46,670 officers and men, of whom 25,240, or 54·08 per cent., were between the ages of fifteen and twenty-five; 15,570, or 33·36 per cent., were between the ages of twenty-five and thirty-five; 4895, or 10·48 per cent., were between the ages of thirty-five and forty-five; and 965, or 2·06 per cent., were above forty-five years of age.

The total number of cases of disease and injury entered on the sick-list was 51,472, which is in the ratio of 1102·89 per 1000, being a decrease, compared with the preceding year, of 55·57 per 1000, and a decrease of 46·28 per 1000, when compared with the average ratios for the last ten years. The average number of men sick daily was 2159·98, which is in the ratio of 46·28 per 1000, and shows a decrease, compared with the previous twelve months, amounting to 5·32 per 1000.

The number of days' sickness, on board ship and in hospital, in the Total Force, was 788,396, which gives an average loss of service from disease and injury of 16·89 days for each person, and shows a decrease, compared with the preceding year, to the extent of 1·99 days.

The total number of persons invalided was 1664, which is in ratio of 3·565 per 1000, and shows a decrease of 13·69 per 1000, compared with the previous year. Out of this total 904 persons were finally invalided out of the service, being in the ratio of 19·37 per 1000, for the whole force, or 54·32 per cent. of the number invalided.*

The number of deaths was 329, which gives a ratio of 7·04 per 1000, and shows a decrease of 1·96 per 1000, in comparison with 1884.

The average number of entries on the sick-list for disease and injury per man on the Home Station was ·87; on the Mediterranean Station, 1·34; on the North American and West Indian Station, ·99; on the South-East Coast of America Station, 1·2; on the Pacific Station, 1·13; on the West Coast of Africa and Cape of Good Hope Station, 1·08; on the East Indies Station, 1·56; on the China Station, 1·55; on the Australian Station, 1·19; and in the Irregular Force, 1·38. The average number of cases per man in the Total Force was 1·1, being ·05 less than in 1884.

The lowest sick-rate was on the North American and West Indian Station, and the highest in the Mediterranean. The ratio per 1000 of men sick daily on the Home Station was 45·09; Mediterranean,

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* The first total includes men temporarily invalided from foreign stations, many of whom on arrival in England, or after treatment in Home hospitals, were again able to join the active force. The number finally invalided represents the waste of the Service from this cause during the year.

53·94; North America and West Indies, 35·47; South-East Coast of America, 37·13; Pacific, 46·07; West Coast of Africa and Cape of Good Hope, 36·13; East Indies, 51·24; China, 46·19; Australia, 39·02; and in the Irregular Force, 53·74. The average ratio of sickness for the Total Force was 46·28 per 1000, which is a decrease of 5·32 per 1000 when compared with the preceding year.

The total number of persons invalided was 1664, of whom 1559 were invalided for disease, and 105 for injury. The ratio of invaliding for disease alone was 33·4 per 1000, and for injury 2·24 per 1000, the total invaliding rate for disease and injury being 35·65 per 1000, which was a decrease of 13·69 per 1000 when compared with 1884. The invaliding ratio on the Home Station was 26·53 per 1000; Mediterranean, 79·66; North America and West Indies, 23·75; South-East Coast of America, 25·49; Pacific, 32·16; West Coast of Africa and Cape of Good Hope, 34·85; East Indies, 60·52; China, 22·34; Australia, 30·28; and Irregular Force, 40·82. Compared with the preceding year, there was an increase in the invaliding rate on the North American and West Indian, South-East Coast of America, Pacific, China, and Australia Stations, and a reduction on the other Stations.

The total number of deaths was 329; of this number 223 were due to disease, and 106 to injury; the death-rate from disease alone was 4·77 per 1000, and from violence 2·27. The total death-rate was 7·04 per 1000, which is a decrease of 1·96 per 1000, when compared with the preceding year.

The ratio per 1000 of deaths on the Home Station, from disease, was 3·72; from violence, 1·03: Mediterranean, from disease, 6·15, from violence, 1·86; North America and West Indies, from disease, 2·91, from violence, 2·08; South-East Coast of America, from disease, 5·88, from violence, 0; Pacific, from disease, 1·75, from violence, ·58; West Coast of Africa and Cape of Good Hope, from disease, 2·85, from violence, 1·71; East Indies, from disease, 12·63, from violence, 3·68; China, from disease, 6·53, from violence, 2·72; Australia, from disease, 2·81, from violence, 4·92; Irregular Force, from disease, 7·01, from violence, 8·04.

Compared with last year, there was an increase in the death-rate on the Mediterranean, North American and West Indian, South-East Coast of America, China, and Australian Stations, and in the Irregular Force, and a reduction on the other Stations.

TABLE showing the RATIO per 1000 of DEATHS from ALL CAUSES, and from DISEASE ALONE, in the SERVICE AFLOAT, between the Years 1856 and 1885, inclusive.

Year.	Death-rate from all causes.	Death-rate from Disease alone.	Year.	Death-rate from all causes.	Death-rate from Disease alone.
1856	15·5	12·1	1871	8·5	6·3
1857	19·4	14·7	1872	8·2	5·6
1858	25·8	22·0	1873	8·3	6·0
1859	16·7	11·8	1874	9·4	6·7
1860	14·7	11·1	1875	8·8	6·9
1861	15·0	11·5	1876	9·24	5·99
1862	15·3	9·6	1877	7·05	4·91
1863	11·8	7·6	1878	14·41	5·82
1864	14·0	9·0	1879	8·58	6·28
1865	11·3	8·1	1880	12·57	4·62
1866	10·2	7·9	1881	10·94	5·27
1867	11·5	8·4	1882	9·49	6·87
1868	8·9	6·5	1883	5·88	4·05
1869	9·9	7·3	1884	9·0	5·83
1870	19·6	6·7	1885	7·04	4·77

STATEMENT showing the Estimated **INCOME** of **GREENWICH HOSPITAL** for the year ending 31st March, 1888, as compared with the Year ended 31st March, 1887.*

DESCRIPTION.	Estimated for	
	1887–88.	1886–87.
	£	£
Revenue derived from the Northern Estates	12,996	11,864
Revenue derived from Property in Greenwich and the Isle of Dogs	4,600	5,800
Interest on Funded Property	35,767	39,909
Dividends on Investments in Indian Railways, &c.	47,679	49,946
Interest on English Government Guaranteed Bonds	1,547	1,547
Interest on Indian Government Guaranteed Bonds	8,120	8,120
Interest on Loans	48,597	38,711
Other Receipts	10,234	12,087
Total Estimated Income	£169,540	£167,984

STATEMENT showing the Estimated **EXPENDITURE** of **GREENWICH HOSPITAL** for the year ending 31st March, 1888, as compared with the Year ended 31st March, 1887.*

DESCRIPTION.	Estimated for		Difference.	
	1887–88.	1886–87.	More	Less.
	£	£	£	£
Expenditure on account of the Northern Estates	3,681	3,749	..	68
Expenditure on account of Property in Greenwich, including Rent for Property in the Isle of Dogs	1,166	1,051	115	..
Greenwich Hospital Department (Admiralty)—Cost of Administration	3,337	3,285	52	..
Law Charges	100	..	100	..
Greenwich Hospital — Salary of Visitor and Governor; Expenses on account of Painted Hall and Chapel, and Superannuation Allowances	3,275	3,602	..	327
Greenwich Hospital Pensions to Officers, and Contributions towards the Education of their Children	8,806	8,862	..	56
Greenwich Hospital Pensions to Seamen and Marines, Pensions to Widows, and Education of Children	118,560	115,909	2,651	..
Greenwich Hospital School	26,669	29,317	..	2,648
			2,918	3,099 2,918
Total estimated Expenditure	165,594	165,775	..	181
Total estimated Income	169,540	167,934		
Estimated surplus Income	3,946	2,209		

GEORGE HAMILTON.
E. ASHMEAD-BARTLETT.

Admiralty, 29*th April*, 1887.

* Extract from Parliamentary Paper, No. 143.

Extracts from Report of Royal Commission on Civil Establishments.*

THE ADMIRALTY.

48. We have found an effective comparison between the expenditure of different periods very difficult to elaborate, as well as unlikely to lead to satisfactory results. It appears to us that the most practical way of initiating reforms is to ascertain the points in which the present system is defective as regards efficient control over work required to be done; and, secondly, to establish general principles, drawn from past experience, upon which any necessary reorganisation or reduction of the staff should be carried out.

49. With the large question of what work has to be done, we have as a Commission no authority to inquire; but when public attention is directed, as it now is, towards ascertaining how the large expenditure upon the Army and Navy can be reduced, it is perhaps not out of place that we should emphasise the obvious consideration that the first and main object should be to obtain a clear idea of what the nation requires. That once done, the establishments at headquarters and elsewhere can be usefully criticised and amended in detail, but not before. General principles, however, remain the same, as we have before observed; and it is to these that we desire mainly to call attention.

50. The business of the Admiralty was, prior to 1832, transacted in two distinct departments, namely, the Admiralty Office and that of the Navy Board. The former was the Department of the Lord High Admiral or of the Commissioners for executing that office; it dealt mainly with the appointment and promotion of officers, the movements of ships, and the general control of the policy of the Navy.

51. The management of the dockyards, the accounts, the maintenance and distribution of stores, the victualling of the Navy, and the arrangements for the transport of troops, &c., devolved upon the Navy Board, which was, however, subordinate to the Admiralty

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* Parliamentary Paper No. 5226.

Office. The Navy Board was first constituted in 1512; in the following reign, that of Edward VI., the constitution was revised, and the civil management of the Navy entrusted to a board of principal officers subordinate to the Lord High Admiral.

52. At the Restoration, the Duke of York, being appointed Lord High Admiral, reconstituted the Navy Board, appointing three Commissioners to act with the Treasurer of the Navy, the Comptroller, the Surveyor, and the Clerk of the Acts. The number of Commissioners varied from time to time, but no change of vital importance took place in the constitution of the Board until 1832, when Sir James Graham, with a view to establishing individual responsibility and putting an end to the friction which had reached serious proportions under the system of dual control, transferred the duties hitherto devolving upon the Navy Board to five principal officers under the direct control of the Board of Admiralty, each department being placed under a Superintending Lord, who represented it at the Board of Admiralty; these officers, each of whom received a salary of £1300 per annum, were:—

The Surveyor of the Navy.
The Accountant-General of the Navy.
The Storekeeper-General.
The Comptroller of Victualling and Transport Services.
The Physician-General of the Navy.

53. The duties of the Surveyor of the Navy were at first confined exclusively to shipbuilding, but in 1860 enlarged powers in connection with the management of the dockyards were attached to the office, the title being changed to that of Controller of the Navy.

54. The duties of the Accountant-General were defined as consisting in keeping all books and accounts connected with the receipt and expenditure of the Navy, including those relating to the Victualling and Marine Services; in seeing that all accounts before liquidation were duly examined and all transactions supported by proper vouchers; that all stores supplied were in conformity with the terms of contract, and, after being satisfied of such correctness, in preparing bills for the payment of the claims by the Paymaster-General.

55. The Storekeeper-General was charged with the maintenance of stock at the various Naval Depots, but as regards shipbuilding materials he was to act in conjunction with the Surveyor of the Navy; it was also his duty to arrange for the purchase of the articles required for the replenishment of stock and for the examination of store accounts.

56. The duty of the Comptroller of Victualling and Transport Services was to superintend the providing, issuing, and duly accounting for all the provisions, victualling stores, clothing, marine necessaries, &c., required for the use of the fleet, the marines, and the convict service, and also for troops in foreign garrisons. In 1862 the transport duties were detached from this office and placed under a Director of Transports.

57. The Physician-General was to have charge of all medical stores, medicines, and instruments, and to superintend all professional details connected with the various medical establishments: the title of this officer was in 1843 changed to that of Director-General of the Medical Department.

58. In 1859 the number of principal officers was increased to six by the addition of the Director of Engineering and Architectural Works, who, with a lower salary and the title of Civil Architect and Engineer, had been a member of the Navy Board.

59. The next important change was made in 1868–9, when a very extensive reorganisation of the department took place.

60. The constructive duties hitherto devolving upon the Controller were transferred to the Chief Constructor of the Navy; the Storekeeper-General was abolished; his purchasing powers, as well as those of the Comptroller of Victualling, an office which also disappeared, transferred to a newly created Contract and Purchase Department, while the examination of the store accounts, both naval and victualling, was handed over to the Accountant-General, the storekeeping functions which alone remained of the powers formerly exercised by the Storekeeper-General and the Comptroller of Victualling being relegated to two officers styled respectively Superintendent of Victualling and Superintendent of Stores, both of which titles were subsequently altered to that of Director.

61. The constitution of the Board also underwent a material change. Hitherto the Controller had been under the superintendence of the First Naval Lord, the officer specially concerned with the efficiency and strength of the fleet, *i.e.*, the only member of the Board who was in a position to enforce economy in shipbuilding was the one who was most interested in increasing the expenditure; the remedy was to give the Controller a seat at the Board, which was done, the appointment of Third Lord being merged with that of Controller.

62. The position of the First Lord was also, for the first time, defined, and he was declared (Order in Council 14th January, 1869) to be responsible for all the business of the Admiralty, the other members of the Board being his assistants.

63. The duties of the office were divided into three principal branches, viz., personnel, matériel, and finance. Over the personnel the First Naval Lord presided, over matériel the Third Lord and Controller, while the control of the finance vested (subject, as in the other two branches, to the First Lord) in the Parliamentary and Financial Secretary.

64. Up to this period all important business had been transacted by the joint action of the Board at their daily meetings. This procedure being found to be ill-adapted to the altered condition of things, the method, which still remains in force, was adopted, of conducting the majority of the business by minute, reserving for the consideration of the Board certain specified subjects only.

65. In 1872 the constitution of the Board was altered by the addition of a Naval Lord and the removal of the Controller, who was, however, again included in the Patent in 1882. At the same time (1872) the position of the Parliamentary and Financial Secretary was materially strengthened by his being empowered to sign, in lieu of one of the Lords Commissioners of the Admiralty, all orders for payment of money, and an additional Naval Secretary was appointed.

66. On the 1st November, 1877, the office of Permanent Secretary was abolished, his duties being merged with those of the Naval Secretary. This arrangement was revised in 1882 by the substitution of a Permanent for a Naval Secretary.

67. As at present constituted (1887) the Board consists of the First Lord, four Naval Lords (one being also Controller), the Civil Lord, the Parliamentary and Financial Secretary, and the Permanent Secretary; meetings are held, usually once a week, for the consideration of any special subject as the First Lord may consider desirable, and also to record the formal approval of the Board upon certain prescribed subjects. Shipbuilding boards are specially summoned by the First Lord, such professional advisers as may be considered necessary being in attendance.

68. The principal departments of the Admiralty are:—

The Secretariat.

The Controller's Department, which is again subdivided into the Ordnance Department, the Constructive Department, those of the Director of Dockyards, the Engineer-in-Chief, and the Director of Stores.

The Accountant-General's Department.

The Victualling Department, to which as well as to that of the Director of Stores, it has recently been found desirable to restore the duty of examining the store accounts, and the Transport, Hydrographic, Contract, Medical, Works, and Greenwich Hospital Departments.

69. Each of these is under the control of a permanent chief, who conducts his work through the individual member of the Board or Financial Secretary to whom the duty of superintending that particular department is allotted; such member of the Board being responsible to the First Lord, who, in his turn, is responsible to Parliament for the efficient and economical working of the whole of the business of the Admiralty.

70. The more important business of every department passes through the Secretary, and, in order to secure unity of action, all correspondence is signed by him as the official mouthpiece of the Board.

71. The constitution of the Board of Admiralty appears to us well designed, and to be placed, under present regulations, on a satisfactory footing. The First Lord of the Admiralty is Head of the Department, and is directly responsible to Parliament, and the other members of the Board are Heads of sub-departments; and we believe it is useful and desirable to bring the First Lord, in this manner, into frequent personal contact with his chief advisers. Such personal communication should, in fact, be encouraged as much as possible throughout all departments, and the advantages of it are illustrated by the practice of Mr. Collett, the Director of Navy Contracts. It tends to a proper understanding between the head and his subordinates, it fosters personal responsibility, and it leads to the simplification of work and reduction of unnecessary correspondence.

72. It appears to us to be doubtful whether all the Naval Lords should be changeable with the Government, and we think that with the view of maintaining the continuity of professional advice, the question of assimilating this part of the administration of the Admiralty to that of the War Office is deserving of careful consideration. We doubt whether a Civil Lord is required in addition to the Financial Secretary.

73. The Secretary's Department was reconstructed on the basis of a report of a committee presided over by Sir Massey Lopes in 1879. The Permanent Secretary, who can be either a naval officer or a civilian, should be the permanent head of the whole office, as the analagous officer is at the Treasury and other offices; and if necessary his powers might be extended.

74. His staff should be precisely like the staff of any other

secretariat, which naturally requires a larger proportion of Higher Division clerks than some of the other departments which have not so much correspondence work. But, subject to this observation, we think, from the evidence before us, that the present system of the Secretariat giving higher pay and providing promotion for clerks in other departments of the Admiralty requires to be carefully watched.

75. The difficulty of expressing an opinion upon the different departments of the Admiralty is much increased by the fact that as regards nearly all, and certainly as regards the most important of them, great attention has recently been paid to them, and various reforms have been introduced which have not yet had time to take full effect, while others are impending. One of the principal departments, however, is that of the Accountant-General, and we attach the greatest importance to the position which he should occupy.

76. In connection with this matter we have, throughout our inquiry, devoted much consideration to the questions connected with the Financial Control of the Great Spending Departments. The subject is very difficult and of great importance. In dealing with it we propose to begin with the Admiralty, because a description of the financial changes of the last two years in that department will serve to elucidate the whole problem, and to indicate the lines on which, in our opinion, a solution can be found.

77. On the 3rd August, 1885, the Select Committee of the House of Commons on Admiralty Liabilities reported that "both the late and present occupant of the office concur that the Accountant-General has no financial control over the other departments;" and that "the evidence before them proves the necessity of a much severer Financial Control, even when operations have to be conducted directly by the First Lord." They added that "the position of the Accountant-General does not enable him to exercise any sufficient general supervision of expenditure, while there is no permanent high official especially charged with finance."

78. In consequence of this report, Lord George Hamilton, the First Lord of the Admiralty, appointed a Committee, consisting of Mr. Ritchie (Chairman); Sir R. E. Welby, K.C.B., Secretary to the Treasury; E. MacGregor, Esq., C.B., Secretary to the Admiralty; and Sir Gerald Fitzgerald, K.C.M.G., Accountant-General, to consider what new rules and alterations in the present system of conducting business at the Admiralty were necessary to ensure an effective control over the expenditure of the different departments. This Committee, which reported on the 23rd September, 1885, reviewed the steps which had been taken from time to time to enlarge the

functions of the Accountant-General, and made the following recommendation.

"As regards finance, the controlling powers of the Parliamentary and Financial Secretary as the Chief Financial Officer at the Admiralty are complete, and we do not conceive that any necessity exists for enlarging his functions. . . . But we are of opinion that permanent assistance should be afforded him, in the direction of financial criticism and control, by placing the Accountant-General in closer relationship than at present to him, by which the necessary improvement would be made in the position of the Accountant-General, while, at the same time, the Parliamentary and Financial Secretary would be in a better position to exercise financial control over expenditure."

With the view of giving effect to these recommendations, an Order in Council, dated the 18th November, 1885, was issued, whereby the Lords of the Admiralty were directed to give the necessary directions to ensure the carrying out of the new arrangements.

79. It will be well to bear in mind what the functions of the Accountant-General were declared to be under that Order in Council. That Order, after directing the appointment of the Accountant-General of the Navy to act as Assistant to the Financial Secretary, and declaring that the Executive Departments should continue to be held primarily responsible for keeping a careful watch upon the expenditure they recommend or incur, lays down the duties of the Accountant-General as follows:

a. Preparation of estimates;
b. Financial review of expenditure;
c. Advising or deciding as to transfer of votes;
d. Seeing that expenditure is properly brought to account;
e. Advising on all questions affecting Naval Expenditure, and that he should not only be made acquainted with expenditure, after it has been incurred, *but be regarded as the officer to be consulted on all matters involving an expenditure of Naval Funds.*

80. Moreover, in the office memorandum, which was promulgated with the Order in Council, it was enjoined, *inter alia*, that the written concurrence of the Accountant-General is to be required to each vote before it is finally approved by my Lords, that each vote is to be referred in sufficient time with explanations to him for concurrence or observation, and that he is to be consulted before any expenditure is incurred which is not provided in the estimates, or before any

money already provided is applied to any purpose other than that for which it was so provided. And, in conclusion, my Lords remark that "in recognising the Accountant-General themselves, and in calling upon the Spending Departments to recognise him to the fullest possible extent as the financial officer who shall be referred to in regard to all proposals involving expenditure, a security will be given for the economical administration of Naval Funds which does not now exist."

81. Concurrently with the operations of the Departmental Committees which resulted in the issue of this Order in Council, a distinct Committee, under the presidency of Vice-Admiral Graham, had inquired into the management and expenditure of the dockyards. Their reports, which will be found in a Blue Book presented to Parliament in 1886, C. 4615, and which are very valuable, showed the urgent necessity for reforms in every department of dockyard work. They complained of the inadequate supervision of labour, of the waste of both labour and materials, of idleness, of defective management, of duplication of accounts, of over-employment of clerks, of useless work. They specially drew attention to the absence of any systematic or concurrent financial control over dockyard expenditure, and to the particularly unsatisfactory system under which the financial business of the yards was conducted. Moreover, they pointed out that the yard store accounts were unaudited, that the Accountant was quite at the mercy of the professional officers, and that, as a matter of fact, there was no independent guarantee that the figures in the expense accounts represented actual facts.

82. With the view of dealing with some, at least, of the evils complained of, while postponing the treatment of the others, the Lords of the Admiralty determined upon the establishment of an independent examination of the dockyard accounts, to be carried out by a new officer, to be called the Inspector of Yard Accounts. This officer's duties were laid down in Admiralty memorandum of the 14th January, 1886, which states that "he is to be considered as the representative of the Accountant-General of the Navy in that officer's capacity as Deputy and Assistant to their Lordships' Parliamentary and Financial Secretary, under the powers conferred by the Order in Council dated 18th November, 1885; and whilst exercising a general supervision over the preparation of the accounts, he will be held personally responsible for the efficiency of the audit of all accounts and of the examination of expenditure."

83. The system under which the Accountant-General as Assistant to the Financial Secretary was thus to exercise an effective financial

criticism of all proposed expenditure, as well as to record all actual expenditure, was formally communicated to the Treasury in November 1885. With some verbal amendments the Treasury expressed their concurrence in the proposals, and ultimately agreed to the costly and considerable modifications of the establishment of the Accountant-General, which were found necessary. The system, accordingly, came into operation in January 1886. The reports of the various Committees to which we have referred, and the Order in Council, were laid before Parliament in the course of the year 1886.

84. Before, however, sufficient time had elapsed to get the system into working order, it was modified in two important particulars:—

I. As regards Store Accounts.
II. As regards Expense and Manufacturing Accounts.

First, as to Store Accounts. The problem of the due administration of the vast quantities of stores, constantly dealt with at the dockyards, has always been one of great difficulty. One phase of it, as to which very different views have been entertained, has been the relation which the Accountant-General should occupy towards the various departmental officers entrusted with the actual custody of stores. Before 1870 these officers, viz., the Directors of Victualling, of Stores, and of Transports, and the Medical Director-General, were responsible to the Board of Admiralty alone, and were not subject to any criticism on the part of the Accountant-General; but in 1870 the store accounts were all concentrated in the hands of the last-mentioned officer. This was the state of affairs at the time of the Order in Council of November 1885, and the examination of these accounts by the Accountant-General was an essential element of the control contemplated by the Order; but in March 1886, only three months after the Accountant-General had been formally invested with his new functions, the Admiralty transferred the examination of store accounts to the departmental officers; still, however, retaining in the hands of the latter a power of "review." This meant that no account could be finally passed until he approved. This arrangement was entered into about August 1886. But in November 1886 the Treasury issued their minute for the independent audit of store accounts by the Controller and Auditor-General. This minute was regarded by the Board of Admiralty as enabling them to dispense altogether with the Accountant-General's "review," and that officer ceased to have any further knowledge of, or power over, the stores.

85. Next, as to the "Expense Accounts." We have already mentioned the appointment of the Inspector of Yard Accounts as

the representative at the yards of the Accountant-General. To this officer was entrusted the superintendence of the mass of yard accounts, &c., which, when finally collated, result in the "expense accounts." These accounts are of great value. Compiled from the wages sheets, from the notes of stores issued locally or purchased at headquarters, they show the actual purposes for which wages have been paid or materials issued. They are the necessary complement of the appropriation accounts. In the hands of an expert they open up all kinds of suggestions and hints, and so constitute a valuable weapon of financial criticism. The position of the Inspector of Yard Accounts, and the collating by the Accountant-General of the expense accounts, were again essential features of the control contemplated by the order of November 1885; but in January 1887, before the Inspector, as representative of the Accountant-General, had been a year in office, the Controller of the Navy recommended that he (the Inspector) should be regarded as representing conjointly the Controller of the Navy and the Accountant-General of the Navy. Various reports followed, with the ultimate result that the Inspector of Yard Accounts was transferred entirely to the Controller's Department, and ceased, in any way, to represent the Accountant-General. It follows from this that the expense accounts, when presented to Parliament, will bear the signature of the Controller, and that the Accountant-General will have nothing to do with them.

86. It is obvious that this mode of dealing with the Accountant-General is the outcome of views completely divergent as to the position and functions of that officer. That this divergence exists at the Admiralty is best illustrated by a few extracts from the evidence, which will also serve to show how far the Order in Council of November 1885 has been carried out. We take the latter point first.

Mr. Miller, Inspector of Dockyards Accounts, says: "We do not possess, as far as I am able to see at the Admiralty as the result of these increased functions, any general check upon the financial administration beyond what existed before." "The Accountant-General has complete touch of all the business after he has been informed of the liability; but it does not seem that, as a departmental officer, he can have sufficient control over the action of the Spending Departments before they incur the liability." "I cannot help saying that the financial control is not exercised by the Accountant-General's Department, as was intended by the Order in Council." "Proposals for expenditure go, as a rule, direct to the Financial Secretary." And, being asked when the Accountant-General would be informed of the order for a new ironclad, he explained that such an order would be given on the authority of the Controller and Secretary, and that the Accountant-General would not necessarily be consulted until the contract had been entered into; and he added that a permanent executive officer in the Admiralty would order a new expenditure, and send it under his recommendation to the Board, without the Accountant-General having had an opportunity to express an opinion upon it. And asked whether, if the printed directions of the Admiralty were strictly carried out, they are sufficient to provide an effective financial control over the expenditure by a permanent officer, meaning by that the Accountant-General of the Navy, he replied, "I cannot help thinking that the instructions appear to be very clear and precise, they are excellent in theory, but it has not appeared to be practicable to carry them out in practice." He added, that the Accountant-General of the Navy is regarded rather as a paying officer and recorder of expenditure than as entrusted with higher functions.

87. Turning now to the attitude taken by the Parliamentary Heads to the policy of the order, the present Financial Secretary says, "the memoranda of the Board defining the Accountant-General's duties do anticipate that there is some financial control in his hands, but, save that at the end of the year, when it is important to take care that you do not get into supplementary estimates, and do not spend money in excess of the votes, his financial control is very limited." Moreover he adds, "under the present system of administration it is impossible for the Accountant-General to exercise financial control, that financial control meaning a check on expenditure before it is incurred; and the Financial Secretary is not in a much better position." Asked as to what, in his view, are the duties of the Accountant-General when estimates are submitted for his concurrence, he limits them to the verification of calculations, but denies that the expression of any opinion as to whether they embody proper expenditure is, or can be, a part of his functions. Yet the Financial Secretary does not deny the necessity for a permanent financial assistant to the Financial Secretary, but would apparently desire that the duties of such an officer should be exercised by the Permanent Secretary of the Admiralty, and not by the Accountant-General. His words are, "I would give the Permanent Secretary such a position that no one connected with any of the Spending Departments of the Admiralty could resent his coming into their departments, overlooking their proposals, and advising the parliamentary representatives as to those proposals."

88. The views expressed by the Financial Secretary are held

substantially by the present First Lord of the Admiralty. The whole tenor of his Lordship's evidence on this point is that better results are obtained by exempting the professional officers from the criticism of a permanent financial officer, rather than, by submitting their proposals to inexpert criticism, weakening their sense of responsibility. Such being the views of the responsible parliamentary heads of the Admiralty, it is not to be wondered at that the officers actually entrusted with the financial functions of the Accountant-General should have met with much opposition. Mr. Main, Assistant Accountant-General, reviewing the effect during the past year of applying the Order in Council of November 1885, says, "The result has been far from encouraging. The tendency to withhold information, or to give partial information, coupled with the tendency to friction when questions affecting expenditure are raised, accompanied by protests, even in cases where these questions are manifestly of a legitimate character, has been most discouraging, and has done much, in my opinion, to weaken financial control of the really effective character contemplated by the Order." Mr. Main admits that the memorandum gives power enough to the Accountant-General, and hopes that with patience the difficulties that he has described may be overcome.

89. Mr. Awdry, who was a member of the Departmental Committee which reorganised the Accountant-General's Department in 1885, with the view of enabling it to carry out this system of financial control, says, "The Accountant-General has not really the power. He has, of course, under that Order in Council, but you can readily understand that the Accountant-General, in his capacity as the principal officer of the Admiralty, cannot very well insist upon the Controller of the Navy, who is a Lord of the Admiralty, furnishing him with information." He would propose that criticism of finance should be removed from the Accountant-General and be placed in the department of the Secretary, where a small staff should collect whatever threads of expenditure were necessary, to enable them to advise the Financial Secretary, while the Accountant-General should become merely a book-keeper and recorder. Mr. Awdry looks upon the controlling power of expenditure as practically a misnomer, and he adds, "All I would have in this branch is, not a department which would have the power of criticising shipbuilding policy, but one which would merely keep the threads of business together and report to the Board, 'We stand in such and such a position, we are committed to such and such expenditure, and we are likely to incur such and such expenditure.'" And Mr. Awdry

defends this proposal on the score of economy. When asked to explain how the Accountant-General can so soon have been reduced from the high position in which the Order in Council put him, Mr. Awdry explains that changes in the department are very rapid; that, since the Order in Council was framed, important changes have taken place; that, formerly, the Accountant-General had the whole of the Professional Accounts kept and checked in his department; that all this has gone from him, and he has not now, consequently, the means at his disposal that he had when the Order was issued; that, in future the Accountant-General will not have any connexion with the store accounts; that the duty hitherto exercised by the Accountant-General of locally examining the dockyard store accounts has now been removed and handed over to the Exchequer and Audit Department; that, on the whole, the functions of the Accountant-General have been so far denuded that the denudation may well go a little farther. Mr. Awdry further states that a Departmental Committee, under the presidency of the Civil Lord of the Admiralty, and consisting of two members of the Secretariat Staff (Mr. Awdry being one), and the present Director of Victualling, are, at this moment, engaged in a reorganization of the Admiralty; he alleges that an economy of £20,000 a year can be effected, and that nearly one half of this saving will result from the reductions that can be made by recognizing the alteration indicated by him in the position of the Accountant-General.

90. It is well to put in contrast to this evidence the testimony of two former First Lords of the Admiralty, namely, Mr. Childers and the Earl of Northbrook.

91. The former considers that the Accountant-General should be the Permanent Financial Secretary of the Admiralty; any view of his functions which makes him a mere book-keeper is entirely wrong; he should be the permanent officer in whom finance centres; if the head of a dockyard, or any great officer who is charged with expenditure, makes a new proposal, undoubtedly the Accountant-General ought to have the opportunity of criticising it, of asking such questions as he thinks desirable, and those questions ought to be answered. He should be at the hand of the Financial Secretary, should have absolute power of criticism and examination; if the term "Accountant-General" has led to its being supposed that he is only a book-keeper, the term had better be altered; on any new head of expenditure being incurred, the Parliamentary Secretary would hardly be performing his duty if he failed to obtain the report upon it of the Accountant-General; his relation to the Permanent Secretary

would be that of two officers very highly placed, who are bound to keep one another well informed of anything going on in the department.

92. With respect to the Admiralty Minute of November, 1885, Mr. Childers expresses his complete concurrence in the view therein embodied, and adds, "Nothing you can do to strengthen that view would, in my judgment, be wrong."

93. Lord Northbrook's evidence is to the same effect. When leaving the Admiralty in 1885, he placed on record the fact that he had felt the want of permanent financial assistance, on account of the removal, one after the other, of three Parliamentary Secretaries, and had therefore resolved to place the Accountant-General in the position of Assistant to the Financial Secretary. He wished that the Accountant-General should be able to make any criticism, or express any opinion he pleased on Admiralty Finance either in estimates or in expenditure, and feels sure that an able man would give opinions of great value. Asked his opinion of the statement, that it is impossible for the Accountant-General to exercise Financial Control, meaning by that check on expenditure before it is incurred, he replied that it should be made quite clear that that statement could not now be correct.

94. We have carefully considered the two views as to the functions of the Accountant-General thus presented, and their bearing upon the financial administration of the great spending departments. We repeat that on the satisfactory solution of the problem of financial control depends the economical management of those departments. It will be observed that the proposed limitation of the functions of the Accountant-General is advocated on the ground of economy and abolition of unnecessary work. We agree that if the Accountant-General is to be nothing more than a book-keeper, if he is simply to record past expenditure and that only as to cash and not as to stores, if he is simply to prepare estimates and not criticise the proposals embodied therein, then the status hitherto assigned him is unwarranted, the pay awarded him is excessive, and the present constitution of his office is, in regard to pay and proportion of higher to lower grade posts, indefensible. We have no doubt that great reductions may be made in his office; but the paramount question is, if we accept this narrowed view of his functions, how can adequate provision be made for the maintenance within the department of an automatic financial check?

95. In the ultimate resort, all financial control must be vested, of course, in the parliamentary heads of departments, subject to the consent of the Treasury, or the final review of the Cabinet; but within the department itself it is the duty of the Financial Secretary to criticise all proposed expenditure from the standpoint of cost, and,

so to speak, to put on their defence all the professional officers when suggesting new forms of expenditure.

96. But in our opinion it would be a great mistake to leave financial criticism exclusively in the hands of the parliamentary chiefs. From the necessity of the case they are constantly changing, and, while in office, are notoriously overwhelmed with parliamentary as well as official duties. It is essential, therefore, that means should be taken to ensure the existence within the department itself of continuous financial criticism, independent of changes of ministry, and of the varying phases of public opinion. The officer entrusted with these duties should be able to keep himself informed of the financial effect of all existing arrangements. He should be at once, through his staff, book-keeper and accounting officer, and should have charge of all subsidiary accounts. He should have the power to follow the appropriation of all moneys, and verify all balances whether of cash or stores; moreover, he must have the right to ask, and power to obtain from the various professional and executive officers, all information necessary to enable him to lay before the Financial Secretary a complete review and criticism of all their proposals. In a word, he should aim at exercising within the department such an examination of suggested outlay as is conducted by the Treasury in the case of the Civil Departments.

97. We are of opinion, therefore, that the Accountant-General of the Navy should be the permanent assistant and adviser, on all matters involving the outlay of public money, to the Financial Secretary, and that the view of his duties embodied in the Order in Council of November 1885 is substantially just and wise. We think, moreover, that if the financial routine instituted by the Order in question has not at present justified the expectations formed of it, it is because it has not been fully and fairly tried. Up to the present time the Accountant-General has not, in his position as assistant to the Financial Secretary, been completely recognized, in practice as well as in theory, as the permanent financial officer to whom all proposals involving expenditure are to be communicated before action is taken. The inevitable consequence of the rapidity with which changes in the duties of the Accountant-General were sanctioned before he could have fully exercised the new functions imposed by the Order in Council has been to impair, if not to destroy, his authority.

98. We can see no good reason, in regard to store accounts, why the audit of the Parliamentary Controller and Auditor-General should have led to the abandonment of the "review" of those accounts, which the Accountant-General of the Navy had previously made.

That "review" should not, in our opinion, mean a detailed examination of each account, but should aim rather at such a collating of the accounts as would enable the Accountant-General to watch the rate and progress of store expenditure, and thereby to criticise effectually all estimates for stores, and draw attention either to depletion or excess. Such a review need not have involved any considerable cost. Further, in our opinion, the checking of store officers by an independent officer within the department is an essential factor in good administration, and the Treasury minute was evidently not intended to supersede due administration of stores within the department. We may remark that the whole subject of the Auditor-General's detailed audit of stores will need careful watching, lest it should tend to weaken departmental responsibility.

99. We think the Expense Accounts should have been left in the hands of the Accountant-General, such modifications being introduced into the mode of keeping them as would have enabled the Controller to obtain from them whatever information he desired.

100. We do not agree with the suggestion that, at the Admiralty, financial criticism should be left to the Permanent Secretary, who should have the help of a small finance branch of his own, leaving to the Accountant-General merely book-keeping duties. To say nothing of the fact that the Permanent Secretary has already quite enough to do, we deprecate the multiplication of finance branches. A proper financial system should embrace all accounts, whether cash or stores, and should be administered by one officer, whose business should be finance and nothing else.

101. The arrangements at present in force at the War Office, with reference to financial control, are based upon the two Orders in Council of 23rd June, 1870. By one of these the Surveyor-General of the Ordnance is appointed, and is entrusted with the control of all army stores, with the custody of all buildings, and with the provision for all transport requirements. He prepares the estimates for all these services, and examines the expenditure relating thereto. By the other the Financial Secretary is appointed, and his duties are to prepare the estimate for the pay of the Army, to collect together the estimates of the other departments. and to "financially review" the expenditure proposed in such estimates. The office memoranda based on these Orders declare that heads of departments are responsible to the Secretary of State that the expenditure under the several sub-heads of the votes they supervise is not exceeded. Any anticipated excess is to be submitted to the Secretary of State, through the Financial Secretary, who is to check the estimated cost

of the proposal, point out its effect upon analogous cases, and its financial bearing upon the total expenditure of the year. The Accountant-General is the assistant of the Financial Secretary.

102. The actual working of the system seems to be that the Accountant-General, as representing the Financial Secretary, can and does control questions of establishment pay and pension, but that, as the Surveyor-General is an officer of co-ordinate jurisdiction with the Financial Secretary, the latter, although nominally possessing the power of review, knows nothing of the details of the expenditure of the former. It follows that the Accountant-General has practically no authority in connexion with the Surveyor-General's votes, and the whole of the store accounts are exempt from his examination. These votes, as stated above, involve an expenditure of £8,176,500.

103. On the grounds we have already indicated, we do not approve of this exemption of the Surveyor-General from the Accountant-General's criticism. Whether at the War Office or at the Admiralty, one principle alone should be adopted, and that principle, in our opinion, should be that every demand for expenditure should be subject to the criticism of the proper financial authority, the final decision resting with the responsible minister. On no other basis do we see any sufficient security for the economical administration of the great Spending Departments.

104. At present, however, the tendency is in a directly opposite direction. The professional departments are gradually escaping independent financial control, and in consequence the Secretary of State for War, or the First Lord of the Admiralty, when dealing with their proposals, will have represented to him only one view, that of the professional demand, while the other view, that of the skilled financial critic, will be wanting.

105. With reference to the clerical staff of the Admiralty and its sub-departments, we give here a short statement of their numbers and cost, based principally on the Navy estimates for the current year 1887–88.

Votes.	—	Numbers.	Cost.
			£
3	Admiralty Office* (*see* Abstract below)	502	136,156
4	Naval Reserves Office	3	487
5	Scientific Branch	9	2,768
6	Naval Yards at Home	523	73,478
7	Victualling Yards at Home	47	10,563
8	Medical Establishments	13	1,577
9	Marine Divisions	5	2,420
13	Naval Prisons	2	226
	Total	1,104	£227,675

ABSTRACT of VOTE 3. ADMIRALTY OFFICE. CLERICAL STAFF.

—	Numbers.	Cost.
Secretary's Department	54	£ 20,984
Controller's Department	93	24,594
Victualling Department	31	7,902
Purchase and Contract Department	28	8,576
Medical Department	17	4,629
Accountant-General's Department. (Town)	205	51,275
Examination of Accounts at the Outports	29	6,441
Director of Transports' Department	23	6,737
Director of Works' Department	16	4,041
Naval Intelligence Department	6	977
	502	£136,156
Abate:—		
For repayment to be made by the Indian Government, being a fixed commuted amount for work performed by the Admiralty in connection with the Indian Troopships	£ 3,870	..
For contribution out of the funds of Greenwich Hospital, being a fixed commuted amount for the work performed in the several Departments of the Admiralty in connection with Greenwich Hospital business .	650	4,520
		£131,636

106. It is admitted by all the responsible officers, with the exception of the Director of Engineering and Architectural Works, that their staff could be reduced; and we are glad to find that the present First Lord has stopped all entries into the clerical establishment for the present.

107. We are of opinion that some of the clerical work, especially that receiving from £350 to £1000 a year, is, like that at the War Office, too highly paid.

108. The routine work in the Admiralty and its sub-departments is, like that in the War Office, of a simple kind, requiring only attention and industry, and a good clerk's education, and it is in the highly paid clerkships principally that we think a considerable saving ought to be effected.

109. There must no doubt be a small Higher Division recruited principally from young men of higher education, but in the abovementioned offices the bulk of the work can be, and ought to be done by men of the calibre of Lower Division clerks. And we take the opportunity here of saying that the evidence we have received establishes the fact, speaking generally, that the class of young men who have entered the service, in both divisions, in recent years, has been satisfactory.

110. It may be sometimes necessary to reduce the staff of an office, by giving pensions to men who are not yet eligible either by age or length of service to receive them, but whose services are not required. And there are no doubt cases where, even when account is taken of the addition to the enormous non-effective charge, a substantial saving may be shown. But it has too often been the case that the places so rendered vacant have subsequently been filled up, while in some of the reorganisations, men have been allowed to retire on abolition terms, who should have been retained in the service; others at the same time being retained whose services might with advantage have been dispensed with. The only security, in our opinion, is to strengthen Treasury control over establishments, always associating with the Treasury for such purposes, as we believe indeed has been generally the course of procedure, the responsible heads of departments affected, without whose co-operation and knowledge no permanent good is likely to be attained, and whom it is most desirable to interest directly in the efficient and economical manning of their offices.

111. A striking illustration of the extravagance which may be caused by reorganisations not carefully watched, and properly administered, is afforded by the case of the Accountant-General's Department of the Admiralty. And we refer to it because public attention has been called to it by a Parliamentary return issued this year, No. 71.

112. An examination of that return brings out the startling fact that, to go no further back than 1877, while in that year the numbers of the staff were 259 and the cost £70,562, in 1881 the numbers were 245 and the cost £55,885, and in 1885 the numbers were 267 and the cost £61,324, though in 1878, 1879, and 1880, in the reorganisation carried out under the Admiralty and War Office Regulation Act, 1878, pensions were granted to the amount of £20,097, and bonuses to the amount of £52,199. Under such control as that which we have shadowed forth above, we do not believe that such an abuse would have occurred.

113. In reviewing the establishments of the War Office and Admiralty, we have not found it possible to criticise in detail the numbers employed in the various branches, nor even to give an opinion upon the necessity or otherwise of all those branches. To do this would require close personal investigation, combined with an accurate knowledge of the work to be performed; and it appears to us that, when the main general principles of the classification and organisation of the clerical services are once determined, it will then be time to review, and if necessary rearrange each office upon those lines. This should be the work not exclusively of each office separately, but of a committee representing indeed the interests and knowledge of such office, but strengthened by the addition of a due element from outside, representing the Treasury and the Government, and ensuring that any rearrangement should be effected with a due regard to uniformity, as far as practicable throughout the whole service.

114. We leave for the present the large question of Treasury control. In the meanwhile we present our first *ad interim* report, fully conscious that it deals but imperfectly with even that portion of our subject which we have hitherto examined, and feeling that in that examination we have, under the terms of our reference, been from time to time necessarily brought into contact with large and difficult questions, without the settlement of which the establishment problem cannot satisfactorily be determined, but which it was impossible and improper for us to investigate. In the case too of many of them, such as Stores and the Manufacturing Establishments, the question of dockyard expenditure, and of contract and purchase and matters concerning the internal administration both of the War Office and the Admiralty, there have been, quite recently, reports of independent Commissions and Committees, as well as of Departmental Committees, affording very valuable, if at some times somewhat conflicting information upon these several points. Lastly, there is at present being conducted, by means of a Parliamentary Committee, a searching investigation into the Army and Navy estimates. These considerations, however, have increased the difficulties which we have felt in our attempt to discharge, within proper limits, the duties entrusted to us.

115. In conclusion, we have to express our regret that at a very early period of our labours, and even before he had taken any part in our proceedings, the services of Mr. Rylands were lost to the Commission by his lamented death. At a later period Mr. Arthur O'Connor, whose services were much appreciated by his colleagues, and would, we feel confident, have been of material assistance to us,

thought it necessary, for reasons entirely unconnected with the Commission, to decline his further co-operation.

All which we humbly submit for Your Majesty's gracious consideration.

M. W. Ridley.
Brownlow.
Rothschild.
Basing.
Henry H. Fowler.
Edward C. Guinness.
Charles E. Lewis.
A. B. Freeman Mitford.
J. Cleghorn.
A. S. Harvey.

Horace Walpole,
Secretary,
6th September, 1887.

I agree substantially in the conclusions of this Report, but I should have preferred not to present it without further time to consider and discuss the terms of it.

Lingen.

Colonial Conference.

AGREEMENT as to ADDITIONAL FORCE to be EMPLOYED for the PROTECTION of the FLOATING TRADE in AUSTRALASIAN WATERS.*

(Approved Draft.)

The Commissioners for executing the office of Lord High Admiral of the United Kingdom of Great Britain and Ireland, &c., and the Governments of Her Majesty's Colonies of New South Wales, Tasmania, South Australia, New Zealand, Victoria, Queensland and Western Australia, having recognised the necessity of increasing the Naval Force for the protection of the floating trade in Australasian waters at their joint charge, have resolved to conclude for this purpose an Agreement as follows:—

Article I.

There shall be established a force of sea-going ships of war, hereinafter referred to as "these vessels," to be provided, equipped, manned, and maintained at the joint cost of Imperial and Colonial funds. **Force.**

Article II.

These vessels shall be placed in every respect on the same status as Her Majesty's ships of war, whether in commission or not. **Status.**

Article III.

The officers and men of such of these vessels as are in commission shall be changed triennially, and of those in reserve as may be considered advisable. **Change of crews.**

Article IV.

These vessels shall be under the sole control and orders of the Naval Commander-in-Chief for the time being appointed to command Her Majesty's ships and vessels on the Australian Station. **Control.**

That these vessels shall be retained within the limits of the Australian Station as defined in the Standing Orders of the Naval Commander-in-Chief, and in times of peace or war shall be employed within such limits in the same way as are Her Majesty's ships of war, or employed beyond those limits only with the consent of the Colonial Governments. **Limit of employment.**

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* Extracts from Parliamentary Paper No. 5091.

Article V.

[illegible]

Notwithstanding the establishment of this joint naval force, no reduction is to take place in the normal strength of Her Majesty's naval force employed on the Australian Station, exclusive of surveying vessels.

Article VI.

Number of vessels.

These vessels shall consist of five fast cruisers and two torpedo-gunboats, as represented by the Archer (improved type) and Rattlesnake classes in Her Majesty's Navy. Of the above, three cruisers and one gunboat to be kept always in commission, the remainder being held in reserve, in Australasian ports, ready for commission whenever occasion arises.

Article VII.

Cost.

1. The first cost of these vessels shall be paid out of Imperial funds, and the vessels fully equipped, manned, and sent to Australia.

Interest on first cost.

2. The Colonies shall pay the Imperial Government interest at 5 per cent. on the first and prime cost of these vessels, such payment not to exceed the annual sum of £35,000.

Annual charge for maintenance.

3. The Colonies shall, in addition, bear the actual charges for maintaining from year to year the three fast cruisers and one torpedo gunboat which are to be kept in commission in time of peace, and also of the three other vessels which are to remain in reserve, including the liability on account of retired pay to officers, pensions to men, and the charge for relief of crews; provided always that the claim made by the Imperial Government under this head does not exceed the annual payment of £91,000.

Cost of maintenance in war.

4. In the time of emergency or actual war the cost of commissioning and maintaining the three vessels kept in reserve during peace shall be borne by the Imperial Government.

Article VIII.

Replacement of vessels if lost.

In the event of any of these vessels being lost they shall be replaced at the cost of the Imperial Government.

Article IX.

Terms of Agreement.

1. This agreement shall be considered to become actually binding between the Imperial and the several Colonial Governments named in the first clause so soon as the Colonial Legislatures shall have

passed special appropriations for the terms hereinafter mentioned, to which Acts this Agreement shall be attached as a first schedule.

2. The Agreement shall be for a period of ten years, and only terminate if and provided notice has been given two years previously, viz., at the end of the eighth year, or at the end of any subsequent year, and then two years after such date. Period.

3. On the termination of the agreement, these vessels to remain the property of the Imperial Government. Vessels to be property of Admiralty.

Article X.

1. The payments named in Article VII. shall be considered as payments in advance, and shall first become due and payable on the dates on which the several vessels are put in commission; and the period of ten years referred to in Article IX. is to be calculated from the date of the first vessel being put in commission. Mode of payment.

2. The share of these payments due from each Colony shall be paid annually in London by the Agents-General and the Crown Agents respectively to such account as the Lords Commissioners of the Admiralty may direct.

3. The accounts of these vessels shall be closed each year on the 31st March, and the difference between expenditure and £91,000 per annum for maintenance adjusted in subsequent annual payments, should the actual expenditure prove less than that sum. Closing of accounts.

Article XI.

Nothing in this Agreement shall affect the purely local naval defence forces which have been, or may be, established in the several Colonies for harbour and coast defence. Such local forces in each Colony to be paid for entirely by that Colony, and to be solely under its control. Local defence forces.

Article XII.

In time of peace two ships, either of the normal Imperial squadron, or of these vessels, shall be stationed in New Zealand waters as their headquarters. Should, however, such emergency arise as may, in the opinion of the Naval Commander-in-Chief, render it necessary to remove either or both of such ships, he shall inform the Governor of the reasons for such temporary removal. Vessels to be stationed in New Zealand waters.

SCHEDULE.

Limits of Australasian Station.

The Australian station is bounded—

N . . on the north from the meridian of 95° east, by the parallel of the 10th degree of south latitude, to 130° east longitude, thence northward on that meridian to the parallel of 2° north latitude, and thence on that parallel to the meridian of 136° east longitude, thence north to 12° north latitude, and along that parallel to 160° west longitude.

W . . on the west by the meridian of 95° east longitude.

S . . on the south by the Antarctic Circle.

E . . on the east by the meridian of 160° of west longitude.

KING GEORGE'S SOUND AND TORRES STRAITS.

Memorandum for Colonial Conference.

The necessity for defending Princess Royal Harbour and some position in the Torres Straits, has been fully recognised both by the Imperial Government and the Australasian Colonies. The joint interest of these Colonies in the defence of these points has been generally admitted on all hands, and the Federal Council in February 1866 passed a resolution to the effect that "some united action should be taken by the Imperial Government and the various Colonies."

Several schemes of defence have been put forward by the War Office and by General Scratchley, who reported on both positions, after a personal inspection. More recently, Admiral Tryon has called attention to the "great importance" of Princess Royal Harbour and Thursday Island, "both in a military and commercial sense." As regards the former, although the present commercial importance of Albany is relatively small, the annual value of the passing trade was estimated at more than £30,000,000 in 1880, and this amount would be largely increased in time of war in the event of possible interruption to the Suez Canal, in which case the bulk of the Australasian trade with Europe would follow the Cape route. Moreover, the development of Western Australia, and the opening up of that colony by the extension of its railway system will undoubtedly confer great commercial importance on Princess Royal Harbour and Albany.

As regards the Torres Straits, the value and bulk of trade following this route in time of peace will certainly increase, and the war importance of a coaling station, as a link between Australasia and the East India and China stations, can hardly be overrated.

The contemplated increase to the Australasian squadron will permit the defences of these two positions to be on a more modest scale than has been hitherto adopted; but the importance of providing the coal stores there with protection against a raid by a hostile cruiser is nevertheless enhanced. In order that the Australasian squadron may be rendered free to act with the utmost vigour in defence of floating trade, protected coal at these vital strategic points becomes a necessity.

Finally, both positions possess considerable natural advantages for defence; and, as has been pointed out by Admiral Tryon, they require for that very reason to be denied to an enemy, who, once established there, could not be dislodged without an effort.

As regards the negotiations which have hitherto taken place, Princess Royal Harbour and Thursday Island occupy a different position.

There has never been any doubt in recent years as to the general scheme of defence of the former, except as to its scale and such details as the actual position of the guns. Moreover, Lord Derby, in his circular despatch of the 12th June, 1885, at a time when war appeared to be imminent, offered on the part of the Imperial Government to provide a certain armament, together with submarine mines, if the Colonies would defray the cost of the necessary works (estimated roughly at £6000), and furnish the necessary garrison. This armament was accordingly prepared for issue; bnt the apprehension of war having meanwhile passed away, it became desirable to reconsider the question with a view to a more permanent arrangement.

In the case of Thursday Island, various schemes of defence have also been prepared, but the whole question has been unsettled in consequence of a proposal to adopt Goode Island as the coal depot, and to create an artificial harbour and anchorage by means of a breakwater. Thus, no definite proposal for the defence of a coaling station in the Torres Straits has ever been jointly considered by the Australasian Colonies, and the Conference will, therefore, enter upon new ground in considering the question.

Whatever may be the future advantages of creating an artificial harbour in the Torres Straits, the Colonial Governments will probably come to the conclusion that its cost would not at present be justified, and H.M. Government consider that present requirements will be fulfilled by a moderate defence of Thursday Island, and that to create that defence without further delay is a wiser course than to embark on a large scheme whose cost can hardly be ascertained with accuracy. In such a scheme, it can hardly be expected that the Australasian Colonies as a whole would co-operate; but, on the other hand, the time may arrive when Queensland will be in a position to create a port on her northern shore, and it appears desirable not to anticipate requirements which cannot be exactly foreseen or provided for.

Under the above circumstances, definite schemes of defence for Princess Royal Harbour and Thursday Island, with estimates, are now submitted to the Conference, and H.M. Government trust that the present exceptionally favourable opportunity of finally arriving at a settlement of the whole question may not be lost.

The general conditions proposed are as follows:—

1. The arrangement to be re-considered at the end of ten years.
2. The necessary works, together with their maintenance, to be undertaken at the cost of all the Australasian Colonies, calculated on the basis of population.
3. A small permanent garrison to be maintained at each place, also at the joint cost of the Colonies.
4. In the case of Princess Royal Harbour, Western Australia to undertake, on the outbreak of war, to increase the garrison to the strength stated. Queensland to make a similar undertaking with respect to Thursday Island. In the case of a war of some duration, it will be for the other Colonies to consider whether they should not assist in providing reliefs for the garrison of Thursday Island. Princess Royal Harbour, on the other hand, being one of the principal ports of Western Australia, should continue to be garrisoned by that colony, unless special circumstances arise calling for an increase of strength beyond the stated amount, in which case the other Colonies might be expected to assist.
5. H.M. Government are not prepared to undertake the cost of defences on Australasian territory in view of the large expenditure they are incurring on the coaling stations on which the lines of communication with the Mother Country will

depend in war. They are, however, willing to provide the following armaments, viz.:—

For Princess Royal Harbour—

8″ R.M.L. Guns
40-pr. R.B.L. „
9-pr. R.M.L. „

as well as the Submarine Mines promised in Lord Derby's despatch.

And for Thursday Island—

7″ R.M.L. Guns.
16-pr. R.M.L. „

With the above armaments, a proportion of ammunition would be provided, and the only cost to the Colonies would be that of improved mountings for the 8″ and 7″ guns. These guns, though inferior to the 6″ B.L. new type guns which it would be desirable to provide, are capable of piercing 8·2″ and 7·6″ of iron respectively at 1000 yards, possess large shell power, and would be mounted so as to range up to 6000 yards. They are also capable of being loaded under cover. Their main defect is a falling off in accuracy at ranges exceeding 2500 yards. In view of the large requirements which have to be fulfilled at stations both at home and abroad, H.M. Government are unable to provide new type guns for Princess Royal Harbour and Thursday Island. It nevertheless appears desirable that these positions should receive some measure of defence without further delay. If, therefore, the Colonies are not prepared at the present time to incur the expense of providing new type guns for Thursday Island and Princess Royal Harbour, estimated at £19,940, it appears, nevertheless, advisable to mount the available armaments with a view to their being subsequently replaced.

H. T. HOLLAND.

April 20th, 1887.

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French Navy Estimates, 1887 and 1888.

It will be seen on comparison with former years that the Estimates for the years 1887 and 1888 have been prepared on an entirely new basis, with the view of showing as distinctly as possible the entire cost of each separate service.

——	PROPOSED FOR 1888.	VOTED 1887.
SECTION I.—VOTE I.—PERSONNEL.		
	£	£
Central Administration	45,710	45,490
Pay of Officers and Seamen afloat and ashore	1,226,030	1,232,080
Troops	452,640	452,640
Inspection—Administrative and financial services	13,180	12,930
Maritime Gendarmerie	34,980	34,970
Constructive and Technical Staff	77,650	83,090
Administrative Staff	308,840	308,830
Medical Staff and Ministers of Religion	93,390	101,820
SECTION I.—VOTE II.—LABOUR.		
Naval Construction—		
Labour for new construction and for first armament of new vessels	327,640	381,040
Repairs of Fleet	233,950	213,950
Naval Ordnance—		
Labour on first production and reconstruction	35,000	35,000
Labour for keeping up existing material	30,780	30,780
Works and Buildings—		
Labour on new works and reconstruction	5,270	3,670
„ keeping up existing buildings	46,010	35,040
Provisions—		
Yard Labour on Provisions and Victualling Stores	31,120	31,120
Works and Buildings—		
Labour on new works and extensive alterations	12,880	11,470
Labour on keeping up existing Plant	282,640	270,640
Miscellaneous Services	16,790	9,930
Carried forward	£3,274,500	£3,293,990

——	PROPOSED FOR 1888.	VOTED 1887.
	£	£
Brought forward	3,274,500	3,293,990
SECTION I.—VOTE III.—STORES.		
Naval Construction—		
Stores for the Fleet	422,570	383,740
Purchase of Vessels built by contract	400,000	520,000
Purchase of Stores for construction of new or altered Vessels and for first commissioning of the same	557,480	739,760
Naval Ordnance—		
First cost of guns, carriages, &c., and reconstruction	293,000	293,000
Repairs and Ammunition	240,360	262,000
Torpedoes—submarine	79,560	84,080
Works and Buildings—		
New works and extensive alterations	114,130	135,440
Cost of maintaining existing buildings, including rents	59,170	69,910
Clothing for Seamen and Troops, including allowance in lieu	200,280	200,280
Provisions for Seamen and Troops, including Table-money	798,120	802,060
Barracks for Troops	44,700	44,700
Material for Medical Service, Science, Art, and Religion	60,860	61,260
Plant for Dockyards, Arsenals, Workshops, Magazines First Establishment, and reconstruction	97,530	93,680
Plant for maintenance and general expenses	123,670	131,850
Fuel and Lights for Dockyards, Arsenals, Workshops, and Magazines	33,940	29,800
Office Furniture, Books, Printing, &c.	43,650	42,840
EXPENSES COMMON TO FOREGOING SERVICES.		
Sea Freight and contingent expenses	168,140	274,130
Lodgings and Travelling expenses	134,960	168,320
Gratuities and Subventions	45,690	44,520
Subvention to the "Caisse des Invalides"	245,180	223,160
Secret Service Money	2,600	2,600
Miscellaneous Expenses	11,350	12,380
Total of Section I.	7,446,440	7,913,500*

* Including Supplementary Estimate for £370,400 voted November 5, 1887.

——	PROPOSED FOR 1888.	VOTED 1887.
SECTION II.—EXTRAORDINARY ESTIMATE.		
NAVAL CONSTRUCTION—	£	£
Wages for construction of new Ships	40,000	80,000
Purchase of Vessels built by Contract	345,520	760,000
Stores for construction of new Vessels	100,000	200,000
New Works	122,680	188,200
Total of Section II.	608,200	1,228,200
RECAPITULATION.		
Section I.—Ordinary Estimate	7,446,440	7,913,500
„ II.—Extraordinary Estimate	608,200	1,228,200
Total	8,054,640	9,141,700

The Supplementary Estimate of £370,400 for the year 1887 was chiefly required to meet insufficient provision under the following sub-heads:—

	£
Ships building by contract	280,000
Purchase of torpedoes	49,600
	£329,600

The sum of £280,000 was urgently required in order to pay off instalments which had been earned by the Société de la Mediteranée on the construction of the Marçeau, Tage, Cecille, Ouragan, and torpedo boats; and the sum of £49,600 was due to Messrs. Whitehead of Fiume for torpedoes already delivered.

ESTIMATE, 1888.

The amount originally demanded by the Minister of Marine for the service of the year 1888 was as follows:—

	£
Ordinary Estimate	7,567,130
Extraordinary Estimate	1,228,200
	£8,795,330

The sum voted was £8,054,640, showing a reduction of £740,690.

Extracts from Report of Commission appointed to examine French Navy Estimates for the year 1887.

Drawn up by Monsieur Ménard-Dorian.

The Commission had for its president M. Rouvier; MM. Heradia and Constans were vice-presidents.

Considerable portions of the Report have been omitted. It is believed that the following translation embraces the principal points raised by the committee:—

Report by Monsieur Ménard-Dorian.

Considerations of a financial character, which may without risk prevail in the examination of the funds allocated to this or that minister, must be put aside as subordinate, when the defence of the country is concerned. We must have in view, above all things, the supreme effort for which so many sacrifices have been cheerfully borne during the last fifteen years by Parliament and the country. The Chamber will recognise, we trust, that in the course of our inquiry we have kept before us the considerations to which reference has been made. With a total expenditure amounting to £7,800,000 we are confident that the administration of the Navy will maintain the honour and defence of the country and fulfil the mission with which it is charged. A nation in the position held by France, venerating its own past history, engaged in important colonial enterprises, and wisely solicitous for the future, must keep in view two main objects. To reduce the Navy, to cut down the number of ships in commission below certain limits, would, in view of the constant development of strength in various navies, be a real abdication. On the other hand, the imperious necessity of renewing and augmenting the *matériel* of naval war imposes on us the duty of not wasting resources on ephemeral objects by putting in commission without necessity vessels having no serious fighting value. It is a better application of our efforts to establish a reserve of force ready to meet serious national danger.

Distribution of seamen.

The instruction of the crews and the officers renders necessary the keeping in commission of six school ships and the Squadron of Evolutions. The squadron has a total force of 4800 men; the school ships absorb 2732 men. The total number of men afloat may be subdivided as follows:—

Extracts from Report of French Commission—continued.

I. Foreign stations, 6250 men;
II. Local forces in the colonial service, 5427 men;
III. The squadron and the sea-going school-ships, 7532 men;
IV. Dockyard, and other similar services, 2130 men;
V. For the afloat defence of the coast, 790 men;
VI. Trials of ships, and unforeseen particular service, 2000 men.

Reductions have been made from these totals. In the Pacific, a cruiser and 960 men have been withdrawn. From the China Seas we have withdrawn two cruisers and one gunboat, their total crews being about 700 men.

Reduction of foreign squadrons.

The reductions in the local forces of the Colonies include one cruiser, two sloops, two transports, six gunboats, twenty armed launches—altogether 1100 men. This reduction is, however, only apparent, and results from the transfer of vessels from the Naval Division at Tonkin to the local Protectorate. This new distribution of our ships, although more satisfactory in several respects than that which formerly existed, is still open to criticism. It does not represent any general idea, nor any fixed line of policy. As new necessities arise, a foreign station is either established for the first time or it may be reinforced; but it would seem that up to the present time sufficient care has not been taken to cut down at the earliest possible date a force of ships for which there is no political necessity, and which do not serve in any way to excite the seamanlike ardour of the crews engaged in the service. We recommend the Government to give its attention to the ideas we have suggested. We do not wish to enter into details; but many persons of authority are of opinion that there is room for much valuable reform.

Reduction in transport service of the Navy.

Already the work of reformation has been commenced, in so far as it relates to the transports. The work must be followed up with method and with prudence. The experience we have gained of a regular service with Cochin China by the means of private enterprise will enable us to make an exact estimate of the cost of this service which, so far as we know, has never yet been arrived at. When we are in possession of the results which will be gained by actual trial, we shall be in a position to determine to what extent the Navy should cease to undertake these services.

Squadron of Evolution.

The composition of the Squadron of Evolution, even its very existence, has for several years given rise to severe criticisms. Ridicule has been directed against these monotonous movements from Toulon to Hyères, and from the Gulf Joan to Villafranc, the

Extracts from Report of French Commission—continued.

regularity of existence being interrupted once a year, sometimes by a visit to the ports of Algeria and to the Archipelago, and sometimes by a coasting voyage along the coast of France. Sarcasm has been carried to the point of exaggeration. We recognise, nevertheless, that there was some foundation for the ridicule thrown upon these proceedings. Is it the case that some of the commanders-in-chief of the squadron have been wanting in activity; or has their zeal been paralysed by the apathy of the central administration? It is certain that not unfrequently the Squadron of Evolution has by no means rendered service proportionate to the expenditure which the keeping of the ships in commission has imposed upon our estimates. When, on the other hand, the squadron is, as it is to-day, under the command of a vigorous leader, when an invigorating impetus is given by an energetic and active minister, great, indeed, are the services which such an organisation may render to the Navy.

We have designedly described the Squadron of Evolution as an institution. We wish by the use of this phrase to insist upon the necessity of its being maintained permanently. This course is necessary both from maritime and political considerations. We shall not stay to give the proof of the necessity. We must have at our disposal in the Mediterranean a force ready to defend the honour and interests of the country. If this force is not at all times mobilised, what would be our position when confronted with those Powers which maintain squadrons in the same waters?

From the naval point of view, if the necessity of the Squadron of Evolution does not at first sight appear indisputable in the judgment of everybody, it is because they have before their eyes not a correct picture of what is being done, but that caricature of which we have just spoken. If we look at the matter a little closer, we must quickly become convinced that the squadron is the centre, let us say more precisely the very heart, of our Navy. The men and officers obtain perfect instruction in their profession under conditions which are not presented in any other part of the service afloat. Above all, they receive a high moral discipline which is an essential condition of the military efficiency of fleets and armies. In order that these results may be obtained, it is not sufficient to assemble ships for months under the command of a flag officer, to be again laid up as soon as the period of the great manœuvres is at an end. It is necessary to maintain permanently institutions which create and preserve a treasury of naval traditions to be handed down to successive generations. Commands should be held for a sufficient space of time to

Extracts from Report of French Commission—continued.

give the officers an opportunity of showing in the sight of their chief and their comrades the true measure of their value.

There has never been any serious question of the dispersion during the winter months of the Squadron of Evolution. The former strength, of six ironclads and two cruisers, may no longer meet the exigencies of the new naval tactics. The squadron may be reinforced by a few ships during the season favourable for manœuvres on a large scale. It may be reduced to a smaller number at other periods of the year; these are modifications which may from time to time be adopted. The essential point is that the squadron should be maintained as a permanent and properly organised force.

Admiral Aube's proposals for the Squadron of Evolutions and annual manœuvres.

The following is the system which Admiral Aube proposes to try: the squadron will consist of two sections. Four ironclads and a cruiser kept in commission throughout the year will be sufficient to meet that necessity of permanence to which we have already made reference. The other ships will only be fully manned during a period of two months, for the great manœuvres. During the remainder of the year their complements will be reduced to three-fifths of the full number. The special ratings will not be reduced so that in case of necessity, the crew can be completed with seamen from the port, and the ship would then be ready for service.

It is evident that there would be in this combination important advantages with a view to a rapid mobilisation of a portion of our forces. But is there not some reason to fear that if the second section of the squadron remain constantly at anchor at Toulon, it may have a prejudicial effect on the spirit and the emulation of officers and men? Ships with reduced complements may become mere floating barracks. We think it our duty to insist on this point, for we see a lurking danger. Even with reduced crews it is possible to go to sea at frequent intervals. As to the least amount of service at sea which will be necessary for the purposes of instruction, we have taken the advice of numerous officers. Each ship should go out three times in each quarter for a period of twelve hours to turn the engines and for target practice. The ships should go out in company once in every quarter for forty-eight hours for evolutions. This, it may be repeated, is a minimum. If we give our approval to the scheme of reduced complements, it is upon the express conditions that the ships of this second section of the squadron shall form an integral part of it, and shall take part in the greater number of its exercises. One uniform standard in drill and general instruction should be maintained by vigorous supervision throughout the squadron. The commander-in-chief, who will have both sections of the squadron equally under his orders, should be bound in honour to see that nothing is neglected, which is necessary for the attainment of this object.

Reduction of complements.

We have to remark that what is called in France a reduced complement is considered by other maritime powers, as the normal strength for all the necessities of navigation. We would particularly instance the case of England, where ironclads of the first class like the Rodney carry 460 men, while our Amiral Duperré requires 700. It would be interesting to make a comparative study in the two sections of the squadron of the organisation of the service with the different strengths. We are pursuaded that experience would show the possibility of doing equally well with less numerous crews. The vessels which are to receive reduced complements include five ironclads, one armoured cruiser, one second-class cruiser, one torpedo cruiser, one sloop of the first class, and a gunboat. This first reserve, while it will complete the squadron during the period of manœuvres, will also provide for reliefs and for any unforeseen particular service. All the ten ships will not be kept at Toulon. It will be important that they should not be too widely scattered. All those which do not form part of the permanent squadron should be concentrated either at Brest or at Cherbourg under the command of an Admiral.

DISTRIBUTION OF FLEET.

Station.	Ships.	Complement.
Atlantic	2 large cruisers; 2 cruisers, 2nd class; 3 avisos; 2 gun-boats	1,700
Pacific	4 cruisers	1,200
China	1 armourclad; 4 cruisers; 3 gun-boats	1,700
Indian Ocean	3 cruisers; 1 aviso; 2 gun-boats	1,100
Levant	1 armoured cruiser; 1 aviso; 1 gun-boat	550
Colonial Stations	2 cruisers; 19 avisos; 5 aviso transports; 10 gun-boats; 37 sloops; 15 smaller vessels; 9 large transports	5,427
	Naval school ships	2,732
	Squadron of Evolution	4,800

The *personnel* afloat may be distributed as follows:—

1. Naval Stations	5,282	officers and men.
2. Colonial Service	5,427	„
3. Squadron of Evolutions	4,800	„
4. Naval School Ships	2,732	„
5. Service of the Ports, etc.	2,130	„
6. Défense mobile	790	„
7. Steam Trials and Unforeseen Missions	2,000	„

Extracts from Report of French Commission—continued.

SQUADRON OF EVOLUTIONS.

This squadron will consist of two sections; four ironclads and one cruiser to be in Commission, with full complements, during the whole year; the other ships to have only three-fifths of their complement on board, except for two months of the year, while engaged in the Grand Manœuvres.

SHIPS IN COMMISSION.

The cost of maintaining the ships in Commission is as follows:—

	£
Personnel	1,480,000
Stores and Labour for Maintenance of Ships	1,160,000
Artillery Stores	160,000
	£2,800,000

SHIPS IN RESERVE.

	£
Personnel	120,000
Stores for Maintenance of Ships	68,000
	£188,000

It will thus be seen that, leaving the personnel out of consideration, the maintenance of our Fleet will cost in 1887 the sum of £1,388,000.

NEW CONSTRUCTION.

The amount provided for the construction of new vessels may be set down at £1,190,000,* and the vote for guns and ammunition at £520,000.

Before examining the programme for new vessels to be constructed in 1887, it may be well to consider the actual value of our ships at the present time.

Hitherto Parliament had only been informed of the value of the Fleet at its cost price, no allowance having been made for deterioration in value owing to wear-and-tear or accident; not even the age of the ships has been stated.

The present calculation has been made on the following basis:—

1. Experience has shown that the hull of a ship, whether in wood or iron, is worth on the average one-fifteenth of its original cost.

---

* Exclusive of Extraordinary Estimate	£1,040,000
Do. Supplementary Estimate	280,000
	£1,320,000

These votes had not been demanded when this report was issued.

Extracts from Report of French Commission—continued.

2. It may be admitted that allowing for ordinary wear-and-tear the hull of a ship, wood or composite, will last 18 years; the hull of an iron ship 30 years; and hulls of light construction, such as torpedo-boats and gunboats 15 years.

Calculations based on these principles show the present value of the hulls and machinery of our Fleet as £12,520,000, whereas, under the previous mode of calculation, they would be shown as £20,080,000.

Adopting the same principle, the following comparison has been made between the value of our Fleet on the 1st of January, 1872, and 1st of January, 1887.

	1 January, 1872.	1 January, 1887.
	£	£
Actual value of Fleet	8,000,000	12,520,000
Value of Ships under Construction	940,800	3,160,000
	£8,940,800	£15,680,000

This difference of about £6,760,000 represents the increase in the value of our Fleet during the 15 years. During this same period the following sums have been devoted to the construction of new vessels:—

	£		£
1872	411,280	1881	1,345,080
1873	614,460	1882	1,304,480
1874	789,720	1883	1,559,600
1875	921,360	1884	1,676,750
1876	1,050,880	1885	1,738,450
1877	1,302,080	1886	1,864,000
1878	1,501,840		
1879	1,504,640		£18,960,700
1880	1,376,080		

Thus from 1872 to 1886 we have applied nearly £19,000,000 to new construction. New vessels may be built either to take the place of those condemned or to increase our naval strength. It has been shown above that the increase in the value of the Fleet amounts to £6,760,000. If we deduct this sum from the total amount spent in new construction, we find that during this 15 years the sum of £12,200,000 has been expended on the replacement of ships condemned as unfit for further use. In other words, we have expended:

	£
On renewal of our Fleet to make up for wear and tear	12,200,000
On actual increase of Fleet	6,760,000
	£18,960,000

Extracts from Report of French Commission—continued.

Though neither the programme of 1872 nor 1879 has been carried out, the above expenditure has provided for the completion of the following ships:—

12 Ironclads (Squadron).
7 Armoured cruisers.
8 Ironclads (Coastguard).
4 Armoured gunboats.
7 Deck-protected cruisers.
9 Cruisers, 1st class.
8 Cruisers, 2nd class.
2 Cruisers, 3rd class.
1 Cruiser torpedo vessel.
12 Avisos, 1st class.
23 Avisos, 2nd class.
7 Avisos transports.
8 Aviso torpedo boats.
14 Gunboats.
32 Sloop gunboats.
8 Sloops.
9 Seagoing torpedo boats.
80 Torpedo boats.
10 Transports, 1st class.
1 Store freight ship.
15 Sailing ships.

On December 31st, 1886, the following vessels were actually under construction:—

6 Ironclads (Squadron).
4 Armoured gunboats.
2 Deck-protected cruisers.
3 Cruisers, 3rd class.
3 Torpedo cruisers.
2 Avisos.
3 Aviso transports.
45 Torpedo-boats.
1 Transport, 3rd class.
2 Sailing frigates.

In considering the above list, it will be remarked that many of these vessels have no fighting value. Some 30 avisos, 10 aviso-transports, 12 transports, 46 gunboats, or sloop gunboats, are for the most part a charge on account of our Colonies.

State of the fleet.

When cleared of all this naval dust, the true state of the fighting fleet at the hour at which we write may be summed up as follows:—

A. Six battleships of the new type powerfully armed. Their combined armaments include four 16½-inch or 75-ton guns, twelve 13·3 inch or 48-ton guns, sixteen 10½-inch or 28-ton guns, and thirty-three light B.L. guns. The actual speed of these ships slightly exceeds 14 knots.

B. Seven armoured battle ships, with less protection and somewhat less speed, of which one alone is iron built. These vessels are still capable of doing good service. Their armament includes forty-two 28-ton guns, twenty-one 16-ton guns, and forty-nine light pieces.

C. Four armoured cruisers; speed about 14 knots; having considerable manœuvring qualities, and being armed with efficient 15-ton guns, these ships form an effective portion of our fighting forces.

D. Three other vessels of the same type. Owing to their loss of speed and somewhat worn-out condition, they can be no longer used for any other service than that of our foreign stations in time of peace in Europe.

Extracts from Report of French Commission—continued.

E. Six armoured coast-defence vessels. Combined armament, six 28-ton guns, and six 48-ton guns. This type of vessels, which has been for some years discredited, seems now capable of being employed with advantage in support of our flotillas of torpedo boats. The manœuvring qualities of our existing vessels are defective; their speed is unsatisfactory.

F. Four armoured gunboats, each armed with a 28-ton gun, complete our actual armoured fleet.

Deficiency in fast cruisers.

The inadequate strength of our fleet in swift cruisers has been pointed out many times. Are we to throw the responsibility upon the Board of Admiralty? Are we to impute blame to the constructors? Has there been failure in the initiation or failure in the execution of plans? Whatever may be the cause, it is a bare fact that we have at the present time only one cruiser capable of steaming 18 knots, and this vessel, to be accurate, should not be described as a cruiser, but rather as a look-out ship for a squadron, with no other serious weapon, and no better protection than that afforded by high qualities of speed. Perhaps we may add one torpedo cruiser of the same speed. This is all that we possess at the present time to meet the swift steamers of the Mercantile Marine, which an enemy might arm in time of war.

Of vessels with a speed exceeding 16 knots we have two frigates and one despatch vessel.

The average speed of the remainder of our cruisers of the first and second class may be taken at from 14 to 15½ knots. The duty which properly belongs to the look-out ships, the class in which, as we have seen, we are so deficient, might in case of need be entrusted to a limited degree to vessels of a new type described in the Navy List as torpedo sloops. These vessels have a displacement of 320 tons, and are expected to realise a speed of 18 knots. They are both torpedo boats and torpedo-boat catchers. One of these, the Couleuvrine, which has been tried with the squadron, appears to have given satisfaction, although owing to a defect of construction, susceptible of remedy, it has not yet been possible to obtain the speed for which the vessel was designed. In a few months we shall have eight vessels of this type.

Number of torpedo boats.

The list of torpedo boats includes at the present time 9 seagoing torpedo boats, 18 torpedo boats of the first class, 41 of the second class, and 9 torpedo videttes.

Such without self-deception on the one hand, or pessimism on the other, is the condition of our fighting navy. The principal defect is

Extracts from Report of French Commission—continued.

the want of speed. We have no ironclad capable of steaming 15 knots. In the Marçeau actually in progress we are promised a speed of 16 knots. In foreign vessels 17 and 18 knots have been obtained. The subject is of such importance that we may be permitted to give details from authentic sources.

In England the Edinburgh, an ironclad of 9150 tons, realised a speed on the measured mile, on the 7th February, 1884, of 17 knots. The Collingwood, a smaller type, in her trials on the measured mile on the 28th May, 1884, steamed 16·8 knots. The Rodney, on the 18th June, 1885, realised a mean speed of 17 knots, although the bottom of the ship was not in good condition, owing to prolonged detention in the steam basin at Chatham. The Howe, in January last, under unfavourable conditions of wind and sea, steamed 17 knots. In Italy, the Italia, armed with four 100-ton guns, in the trials, which took place in the month of March last, attained a speed of 18 knots.

Method required in shipbuilding.

We have only quoted vessels actually completed for sea. We said a little while ago that we had given up programmes of construction to be spread over a long period of years. We wish to speak of programmes which can be carried out in an interval of six or eight years, and representing ships which could be proceeded with simultaneously in the dockyards. It is, however, evident that construction must not be undertaken in a casual manner without preconceived plans. Such a course must lead to a total want of symmetry in the fleet, the ships representing only too faithfully the antagonistic ideas which may from time to time have prevailed, through the unstable tenure of our political offices. In shipbuilding, perhaps, more than in any other part of the administration, we require method, continuity, a certain special skill in dealing with periods of transition in the construction for war. We should take care never to allow ourselves to be overtaken upon the outbreak of a war in a state of disorganisation, having condemned as useless all that existed before, without having replaced the old types with the new—in a state, that is to say, of suspense between yesterday and to-morrow.

Advocates for torpedo boats v. ironclads.

Bold theoretical writers have endeavoured to guide public opinion to the approval of fixed views on these difficult subjects. They have proposed to set aside as of no value the whole existing forces of the Navy, to abandon the ships now in course of construction, and to devote our entire resources to the multiplication of the mosquito flotilla, which they believe will do battle with infallible success against the armoured giants. Whatever be the value attaching to

Extracts from Report of French Commission—continued.

these writings, they have at least aroused the public from their former apathy on these subjects. There is at the present time in England the same profound interest in what concerns the Navy which has always been found in that country. Everything is undergoing examination, and nothing but good can result from so much earnest discussion.

Experiments in progress.

The committee on the Navy Estimates must not take a side with the theorists, and pronounce itself in favour either of this view or that. We may at once state that such an attitude has not been suggested by the responsible ministers. We are not about to enter upon a new era of construction; we shall advance with a somewhat firmer stride in the direction in which we have been moving for the last three years. Trials have been undertaken; they are being conducted at this moment under less sensational conditions, it may be, than during the great manœuvres of the squadron: but, perhaps, with more method and with better promise of results. It has been desired to arrive at definite conclusions on the most effective method of fighting heavy guns, and quick-firing guns, on the value of the torpedo as an offensive weapon, on the impenetrability of armour, on the best method of internal subdivision, on the efficiency of torpedo nets as a method of defence. The solution of the problems we have indicated will assist materially both in the study of naval tactics, and in the preparation of designs for ships. Important results have already been obtained, which it is no part of our duty to publish to the world.

Programme for 1887.

The point with which we have to deal is the programme of construction for 1887, which the Minister of Marine has put before us in the light of these experiments. It is proposed to appropriate £510,000 to the six armoured battle-ships now in hand. One of these, the Amiral Baudin, is to be completed in 1887. The Formidable and the Marçeau are promised in 1888. Work has been suspended on board the Brennus and the Charles Martel. This prudent decision has been unfairly condemned as an abandonment of work which had been taken in hand. It is true that a provisional sum of slightly more than £30,000 was taken for expenditure to the 31st December, 1885, upon these two ships, but one only has been commenced. The money voted represents materials for construction, which may hereafter be devoted to other services.

A sum of not quite £80,000 is to be appropriated to four armoured gunboats, of which two will be completed in 1887. Two large frigates, 5766 tons and 7000 tons respectively, have been ordered from the private yards of La Seyne and St. Nazaire. Together they will cost from £600,000 to £640,000. They should be completed in 1888. These vessels will have a speed of 19 knots. They are of the protected type, with an armoured deck, and coffer-dams filled with cellulose. A sum of about £240,000 is appropriated to these vessels in the Navy Estimates of 1887.

Only three cruisers of the first class, of about 4,000 tons, will be laid down in our dockyards. The estimate for each vessel is £180,000.

Two cruisers of the second class, and three of the third class, are also included in the list of ships to be commenced. It is proposed to appropriate, during the current year, £160,000 to these vessels.

Three cruisers of the Condor type will be completed in 1887, at an expenditure of £35,000.

Fifty-one torpedo boats, ordered from the contractors in 1885, will be delivered in the course of 1887. The sum due upon these vessels amounts to £86,000. A torpedo-boat of a new type has been ordered from the Société de la Loire. The displacement is 148 tons. The armament will consist of four torpedo launching tubes and two quick-firing guns. It is a condition of the contract that the vessel must maintain a speed of 25 knots for two hours. Two sloops will be completed, and one is to be laid down. We have three transport sloops, a transport, and two sailing frigates, in construction. The expenditure proposed for these vessels is £110,000.

Cruisers laid down by Admiral Aube.

It will be seen from the programme that the administration of Admiral Aube has impressed its policy upon our building programme mainly in the proposal to lay down eight swift cruisers. In taking this step it is in accord with views generally entertained. The point open to discussion is as to whether naval requirements will be met in the types adopted in a manner which is entirely satisfactory.

In the general term cruisers, we contemplate a class of vessels intended to operate at a great distance from the mother country. The defence of our coasts is specially the duty of our fighting squadron. The sphere of the cruiser is the open ocean. The ship must, therefore, fulfil two primary conditions. She must be a thoroughly seagoing ship, she must carry supplies sufficient for an extended cruise, without putting into port, and without the means of replenishment. Of these supplies, unquestionably coal is the most important. The coal endurance of a cruiser must be increased in proportion as the nation to which she belongs is deficient in coaling stations. In the construction of our cruisers this essential point

Extracts from Report of French Commission—continued.

should never be dismissed from view. Speed is an essential quality in a cruiser. It is not less necessary that the vessel should be capable of maintaining speed for a long space of time. With these qualities of speed and coal endurance the cruiser must combine those of a fighting ship.

Cruisers—types required.

The Board of Admiralty, when last consulted, expressed its views as follows:—"The Council insists strongly that ships intended for isolated operations should possess great individual power. The cruiser must be autonomous, swift, and powerful, while it is of extreme importance to obtain a type of the minimum size which will meet the conditions laid down. All our investigations point to the conclusion that it is impossible to produce a fighting ship, in all respects efficient and capable of undertaking a long and extended cruise at sea, without reaching a tonnage of about 4000 tons, or approximately the dimensions of the new cruisers of the chief foreign maritime powers." The Council accepts for European waters ships of limited tonnage, in which every consideration is subordinated to that of exceptional speed. These vessels, are, however, not in the true sense cruisers, and should, in the judgment of the Council, be designated as sloops for destroying or protecting commerce.

It is evident that the latter term is applicable to the three cruisers of the third class of the Surcouf type laid down this year. With a displacement of 1850 tons they will have a speed of 19½ knots. Their coal capacity will be limited to 200 tons, or sufficient for 2400 knots at the reduced speed of 10 knots.

In the cruisers of the second and the first class the displacement will range from 2600 to 4200 tons. The speed should be 19 knots. At 10 knots they should be able to cover 6000 miles. They carry a powerful armament.

It only remains for us to express a hope that the construction of these vessels will not be unduly delayed, and that the plans once approved will not be re-considered for the sake of introducing improvements. Every new type should be completed in accordance with the original design. It is the only means of testing by actual trial the good qualities and the defects of the type.

Delays in completing.

This brings us to speak of the delay in completing the new ships included in the list already given.

The construction of new vessels is entrusted either to private firms or to our own dockyards. There is, as a rule, no unreasonable delay in the completion of ships entrusted to the private firms. It is no small advantage to be certain of getting a ship delivered for a certain

Extracts from Report of French Commission—continued.

sum at a certain date; hence the preference shown by Parliament each year for this mode of building.

For the year 1885, out of a sum of £1,720,000 for new construction, £720,000 was executed by private firms.

For the year 1886, as well as for 1887, a like sum of £720,000 was provided; this sum was subdivided as follows—viz., £440,000 for the purchase of ships, and £280,000 for the purchase of machinery for ships built in the dockyards.

The private trade has under construction one armoured battleship, to be delivered in 1888; two large cruisers, which will be finished in the first months of the year 1889; one cruiser of the third class; fifty-two torpedo boats, and one transport.

Remedies—dockyards to be devoted to special descriptions of work.

It is scarcely necessary to add to what has been already said with reference to the slow progress of construction in our dockyards. The most effective remedy has been many times pointed out. It is the specialisation of certain dockyards, which, relieved of the work of fitting out ships, would become real building yards, and could be worked upon the same system which is adopted by the private trade. The plan we suggest has for some time been followed by the administration in the case of the dockyard at Lorient. Another cause of the slow progress of work in the dockyards is one which Parliament is never weary of pointing out, and which the Minister can alone remove. It is the perpetual alteration of designs while in course of execution. We cannot insist too strongly that this fatal habit should be discontinued.

Workmen should be stimulated by rewards for exertion.

We do not wish to speak with too much severity of the workmen; but it is impossible to pay even a cursory visit to a public dockyard without being struck with their demeanour and appearance. The work is done languidly and without spirit. It would seem as if the workman had no other thought than to look forward to the day when he will become entitled to pension. It is not the men that we hold responsible, but the system which gives no motive to exertion. There is nothing to fear, nothing to hope for. The rate of daily wage is approximately uniform. Promotion is more or less automatic. Provided he does not commit breaches of discipline the workman is sure of ending his days in the dockyard. He must, indeed, be regarded not so much as a workman as a salaried official. Having criticised with severity, we gladly admit that if he is called upon to execute a work of real urgency consequent upon the active operations of war, if, for example, ships have to be commissioned for Tonkin, then all this sloth is cast off, and prodigies of activity are performed, because

Extracts from Report of French Commission—continued.

it is felt by the workman that he is rendering a valuable service to his country. The stimulus which at present is supplied only by extraordinary circumstances, ought to be brought to bear upon the workman at all times. He must be made to feel that the future depends upon his work. Pay should be strictly proportioned to results. Piece work, advancement to the established list after a trial of sufficient duration, these are means which it is easy to employ, which are employed in all workshops other than those belonging to the state.

The number of the workmen employed on naval construction, increased to meet the extraordinary requirements for the operations at Madagascar and on the China Seas, will be reduced in 1887 to the normal number of 21,552. The distribution will be approximately as follows:—

Arsenal at Cherbourg	3,700	workmen	1,110,000	days' work.
„ „ Brest	5,200	„	1,560,000	„
„ „ Lorient	3,500	„	950,000	„
„ „ Rochefort	2,400	„	720,000	„
„ „ Toulon	4,880	„	1,464,000	„
	Total for the 5 ports		5,804,000	
Manufactory of Indret	1,020	workmen.		
„ „ Guérigny	852	„		

Of this approximate total of 5,804,000 days' work, 2,065,000 will be devoted to new construction.

The average proportion is thus ·356 for new construction, and ·644 for other works. But the proportion is not the same for all the ports.

Lorient applies ·60 of its labour to new construction.

Rochefort	·37
Cherbourg	·33
Brest	·30
Toulon	·23

PROGRAMME FOR NEW CONSTRUCTION.

The following is the programme for new construction in 1887 in each of the yards:—

Cherbourg will complete one armoured gunboat, the Cocyte; the completion of two others is anticipated in 1888; this is a delay of two years as compared with the estimate formed in 1885.

The aviso-transport Manche will receive 50,000 days' work, and will probably be fit for service in 1888.

Extracts from Report of French Commission—continued.

The third-class cruiser Surcouf, laid down in April, 1886, should be finished in three years.

A first-class cruiser is put down for 34,000 days' work in 1887.

Brest will complete at last, if nothing should arise to upset the calculations, the Amiral Baudin; the Neptune will be advanced to $\frac{67}{100}$, and will certainly not be ready for steam trials before 1889. In October, 1884, we were promised that these armourclads would be ready for their first commission in 1886 and 1887 respectively. Their construction will have occupied a period of from eight to nine years.

The new work will comprise a large barbette cruiser and a second-class cruiser, which will occupy 80,000 and 20,000 days' work respectively.

Lorient puts off for another year the completion of the Formidable and Hoche. One armoured gun-boat, and two avisos will be completed, and one sailing frigate will be advanced to $\frac{77}{100}$. The only new vessel to be laid down in 1887 is an aviso of the first class; it is proposed to concentrate all the resources of the workshop on the two ironclads.

Rochefort ought to complete the torpedo cruiser Epervier, and one sailing frigate; there will only remain on the stocks one aviso-transport in a forward state of advancement; all available time will be employed on the commencement of two swift cruisers.

Toulon has the following programme—to complete the two torpedo cruisers Faucon and Vautour, and to advance the armourclad Magenta to $\frac{51}{100}$. It is impossible for this ship to be finished in 1888, as promised. A cruiser of the second class is to be laid down. The armourclad Caïman does not appear on the programme of new construction for 1887. We are in a position, however, to state that her completion will require during this year many thousand days' work.

It is interesting to compare the programme for new construction in our yards with that of England.

England has under construction at the present time—

5 Armourclads of from 10 to 12,000 tons.
7 Armoured cruisers of about 5000 tons.
9 Torpedo cruisers from 1600 to 1700 tons.
1 Cruiser of 3600 tons.
5 Gun-boats.
5 Torpedo gun-boats.
1 Aviso.

This represents a total tonnage of about 116,000 tons.

For France, the calculation made on the same basis shows

Extracts from Report of French Commission—continued.

105,000 tons. If we consider, however, the proportion of the amounts voted for new construction, which is much larger in the English than in the French estimates, and the greater resources of the English dockyards and private shipbuilding establishments, we see at once that actual production is measured not by the list of ships commenced, but by the rapidity of their construction.

THE PERSONNEL.

We would only remark with regard to the Personnel, that any reductions we have proposed do not touch the seaman class, but only what we may call the non-executive element on board ship. Hitherto, in the same chapter, and in the same vote, "staff and crews on shore and afloat," have been included in the different ranks all who, at any time of their career, could go on board ship. Thus, in the same chapter as the Naval Officers, we see provision made for Hydrographical Engineers, the Commissariat, Medical Officers, Chaplains, &c. We refuse to put all these officers in the same category, in spite of the relative rank which they enjoy.

We must not forget that the *raison d'être* of the Navy is to fight, and that all classes have not the same essential and executive duties.

We have not touched those classes which constitute essentially the fighting strength of the Navy; our proposals for reduction affect mainly the non-combatant classes.

The total number of naval officers and seamen provided for in Estimates for 1887 is as follows:—

Rank.	On Shore.	Afloat.	Reserve.	Total.
Vice-Admirals	18	1	..	19
Rear-Admirals	24	6	..	30
Post-Captains	64	30	6	100
Captains of Frigates	121	67	13	201
Lieutenants	310	373	41	724
Ensigns	219	201	..	420
Naval Cadets	..	297	..	297
Professors	..	13	..	13
Engineers-in-Chief	72	45	17	134
Constructive Staff	124	3	..	127
Hydrographical Staff	15	2	..	17
Commissariat Officers	330	102	11	443
Medical Officers	398	154	23	575
Crews	5,417	25,388	2,304	33,109
Pensioners for Torpedo Service	2,356	..	..	2,356
Totals	9,468	26,682	2,415	38,565

Extracts from Report of French Commission—continued.

The total numbers provided for in 1886 were 42,367.* The decrease of about 4000 relates exclusively to those borne for service on shore.

TROOPS.

	For Service in France.	For Service in Colonies.	Total.
MARINE INFANTRY—			
Officers	425	298	723
Non-commissioned Officers and Privates	11,574	8,333	19,907
MARINE ARTILLERY—			
Officers	215	56	271
Non-commissioned Officers and Privates	3,758	1,473	5,231
NAVAL POLICE—			
Officers	18	..	18
Men	601	..	601
Totals	16,591	10,160	26,751

RECAPITULATION.

NAVAL OFFICERS AND SEAMEN	**38,565**
TROOPS—	
Marine Infantry	20,630
Marine Artillery	5,502
Naval Police	619
	65,316

In addition to the above 2295 officers and men, troops are paid out of the Funds of the Protectorate of Tonkin.

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* See *Naval Annual* for 1886, p. 466.

Extracts from Report of Commission appointed to examine the French Navy Estimates for the year 1888.

Drawn up by Monsieur MÉNARD-DORIAN.

If the proposals of the Commission are adopted, the amounts voted for the Naval Service in 1888 will be as follows:—

	£
Ordinary Estimate	7,446,440
Extraordinary Estimate	608,200
	£8,054,640

In addition, the sum of £140,000 will be available on account of the proceeds of sale of old stores. The Navy Estimates as revised by the Commission show a reduction of about £740,000 on the estimate originally proposed by the Minister of Marine.

Extraordinary Estimates.

There is in the nature of things no line of demarcation between expenditure incurred under the ordinary and the extraordinary estimate. The renewal of the fleet, and the substitution of new for old types of vessels, are permanent obligations, which ought to be provided for in ordinary estimates. To provide for such expenditure by means of an extraordinary estimate is a financial arrangement which circumstances may sometimes render necessary, but which should never be the ordinary rule.

This, nevertheless, is not the principal objection to an extraordinary naval estimate. The ordinary estimates are calculated on certain fixed lines, and provide year after year for approximately the same expenditure. The laying down of new types of vessels can only take place in proportion as the completion of former work leaves money available. Progress is thus continuous, and if designs of ships should prove erroneous, they can be stopped or modified. We do not pretend that the mere fact that ships are charged to the ordinary rather than the extraordinary estimates is a guarantee that the design is faultless. We cannot forget the construction of many ships which have proved failures, and the expense of which has thrown so useless a charge on Navy Estimates. But if these deplorable errors are possible in an ordinary estimate, the opening of an extraordinary estimate renders them inevitable.

We are far from saying that the ships for which provision was made in the extraordinary estimate for 1887 are useless; on the contrary, it is certain that our fleet was deficient in speed, and that Admiral Aube rendered a true service to the Navy by laying

Extracts from Report of French Commission—continued.

down rapid cruisers and quick despatch boats. But it is equally certain that the Extraordinary Budget would have allowed everything to be sacrificed to this idea of speed, which is certainly an element, but by no means the only element of naval power.

If the plan for the reconstruction of the Fleet had been carried out in the way in which it was first presented to Parliament by Admiral Aube, we should have been committed to an expenditure of about £5,600,000 on ships in which every other feature had been sacrificed to the single consideration of speed. And who can say that the conditions of war will not change in consequence of some new discovery, as they have so often done during past years? It is not desirable, therefore, to embark on long programmes; it is necessary to watch new facts, and to learn from the experience of other nations. The Extraordinary Budget is an instrument full of dangerous temptations to pursue a rash and impulsive shipbuilding policy. The Extraordinary Navy Estimate of £1,200,000 voted for 1887 was intended to provide for the laying down of the following vessels:—

3 Cruisers, 1st class.
3 „ 2nd „
3 „ 3rd „
8 Eclaireurs.
24 Torpedo Boats.

These ships had not been all arranged for when Admiral Aube left the Admiralty, and his successor, M. Barbey, while continuing those vessels already commenced, resolved to considerably diminish the numbers originally intended to be built; hence the reduction in the amount of the Extraordinary Estimate for 1888. We may hope that in 1889 new vessels will cease altogether to be charged to an Extraordinary Estimate.

Value of the fleet.

During the year 1887 the increase in the value of the Fleet amounted to about £1,000,000 sterling, calculated as follows:—

1. Requin, ironclad of 7200 tons, armed with two guns of 42 centimetres. This vessel has been constructed by the Société de la Gironde, after a delay of three and a half years.

2. Epervier, a torpedo cruiser of 1280 tons, laid down at Rochefort 13th March, 1883, representing, with armament, a value of over £80,000.

3. Gabriel Charmes, a gunboat, whose trials, according to official reports, proved unsatisfactory. Her gun has been taken out, and she will be fitted as a torpedo boat. She appears on the list as worth £10,000.

Extracts from Report of French Commission—continued.

4. Forty-four torpedo boats, representing a total value of £440,000.

The following vessels have been struck off the list:—

4 Ironclads.	3 Avisos.
3 old Cruisers.	5 Transports.

Certain small vessels hitherto employed on special services also disappear.

Allowing for depreciation, the real value of the Fleet on 1st January, 1888, is taken at £12,541,200, as compared with £12,549,950 on 1st January, 1887. A certain number of the vessels appear without depreciation, in consequence of extensive repairs made in 1887. The following table will show to what extent the cost of ships has been understated in previous Estimates:—

Name of Ship.	Cost of Ship exclusive of Machinery and Guns.		State of Advancement, 1st Jan., 1888.	
	As shown in Estimates, 1st Jan., 1887.	As shown in Estimates, 18th June, 1887.	As Calculated, 1st Jan., 1887.	As Calculated, 18th June, 1887.
Armoured Battle Ships—	£	£	Percentage.	Percentage.
Neptune	400,000	546,800	67	50
Formidable	444,000	602,000	97	93
Hoche	408,000	559,000	71	70
Magenta	408,000	546,800	51	48
Amiral Baudin	428,800	602,000	100	93
Armoured Gunboats—				
Cocyte	64,000	144,520	100	79
Phlégéton	64,000	144,520	89	25
Styx	64,000	144,520	67	12
Grenade	43,200	62,640	100	78
Cruisers, 1st class—				
Dupuy de Lôme	138,400	160,000	60	9
Jean Bart	138,400	160,000	40	11
Cruisers, 3rd class—				
Surcouf	36,400	77,920	53	82
Forbin	36,400	77,920	49	67
Torpedo Cruiser—				
Vautour	27,200	51,600	100	60
Aviso Transports—				
Manche	22,000	45,280	67	32
Rance	22,000	45,280	100	84
Vaucluse	22,000	45,280	84	34
Sailing Frigates—				
Andromède	28,800	46.800	67	47
Melpomène	28,800	46,800	100	88
Totals	2,824,400	4,109,680		

It is instructive to notice the immense increase over the original Estimates. It will be necessary to expend £4,109,600 on vessels whose original estimate was £2,824,400. In the majority of cases

Extracts from Report of French Commission—continued.

the increase amounts to 45 per cent. The following ships are now on the stocks:—

- 6 Ironclads (Squadron).
- 4 Armoured Gunboats.
- 2 Deck-protected Cruisers.
- 3 Cruisers, 1st class.
- 2 „ 2nd „
- 6 Cruisers, 3rd class.
- 1 Torpedo Cruiser.
- 3 Aviso Transports.
- 2 Sailing Frigates.

In 1888 Brest will complete the Amiral Baudin, and Lorient will complete the Formidable. Both these ironclads were laid down at the end of 1878.

Two armoured gunboats will be finished at Cherbourg and Lorient, after six years of experiments and modifications, which have more than doubled the original estimates for the vessels. The delays in the dockyards may be compared with the rapid progress of a ship entrusted to the Société de la Loire, which will construct the Tage, a large steel cruiser of 7000 tons, in three years.

We may also count on the completion of two or three cruisers of the 3rd class, which will have been constructed in two and a half years at Cherbourg and Rochefort, and one torpedo cruiser at Toulon. In 1889 we are promised the completion of the Neptune, a squadron ironclad laid down at Brest in October 1880; of the Marçeau, ordered from La Seyne about the same time, and of the large protected cruiser Cécille, ordered from the Forges et Chantiers de la Méditerranée towards the end of 1885. The delivery of the armoured vessels, Hoche and Magenta, commenced in 1880 at Lorient and Toulon respectively, has been postponed till 1890. It thus takes our dockyards ten years to produce an ironclad ready to take the sea.

WORKMEN AT THE DOCKYARDS.

On the 1st October, 1887, the following was the distribution of the workmen at the different yards:—

Cherbourg	3,671
Brest	5,241
Lorient	3,617
Rochefort	2,521
Toulon	4,700
Indret	1,061
Guérigny	881
Minor Ports	19
Paris	69
Total	21,780

It is hoped to reduce this number to 21,617 on the 31st December, 1887.

Extracts from Report of French Commission—continued.

PROGRAMME OF WORK, 1888.

The construction of new vessels will occupy 10,300 men, the maintenance and repair of the Fleet about 6000, and general service 5300.

The amount provided for the repairs of the Fleet has been increased by £48,000, in consequence of the increased number of ships commissioned in 1886 and the commencement of 1887.

Two new ships will be laid down, one at Brest, the other at Lorient, and will occupy the hands that will become available owing to the completion of the Amiral Baudin and the Formidable.

At Brest it is proposed to construct an armoured cruiser of the first class, with the following principal characteristics:—

Artillery: two guns, of 19 centimetres, and six of 16 centimetres, in addition to quick-firing and machine-guns. Four torpedo-tubes.

Steel armour from end to end, and a steel-protected deck.

Minimum speed, 20 knots, with forced draught. The coal endurance to be equal to 4000 knots.

This armoured cruiser will be called the Dupuy de Lôme, a name originally proposed for a first-class cruiser it was intended to build at Cherbourg. This first-class cruiser was abandoned because it was considered the new vessel described above would be best adapted for the latest requirements of offensive and defensive warfare.

The cost will be at least £400,000, but the design is not sufficiently advanced to admit of any further details.

It is not probable that more than 50,000 days' work will be employed on this vessel during 1888, but when she is once fairly commenced, every effort will be made to complete her in three and a half years.

At Lorient the armourclad Brennus will be taken in hand. It will not be forgotten that, at the end of 1882, the order had already been given to commence an armourclad of the same name at this port. The following are the sums which have already appeared in the expense accounts as expended on this vessel:—

—	Materials.	Labour.	Total.
	£	£	£
1882 . .	120	136	256
1883 . .	3,284	1,748	5,032
1884 . .	14,852	5,592	20,444
1885 . .	2,400	1,600	4,000
1886 . .	4	64	68
Totals .	£20,660	£9,140	£29,800

Extracts from Report of French Commission—continued.

On the 24th October, 1884, the decision was arrived at, by desire of the Commission, to postpone the construction of the Brennus. It is difficult, therefore, to explain how an expenditure of £4000 could have been incurred in 1885. However this may be, a considerable amount of material has been purchased for the Brennus, and a certain amount of work done on her keel. The question therefore arose whether it would be desirable to adopt the plans of 1882, with certain unimportant modifications. Had these plans been adopted, we should have had a vessel no longer equal to the requirements that have arisen since she was first designed. However regrettable the loss of some thousands of pounds may be, the minister determined to call upon the constructors for a vessel answering in every respect to the latest requirements.

The distinctive features of the new Brennus may be summarised as follows:—

Armament:—Three guns of 34 centimetres, and ten of 16 centimetres; four quick-firing guns of 65 millimetres, eight of 47 millimetres, and eight machine guns of 27 millimetres; the large guns will be mounted either in closed or barbette turrets.

Several torpedo-launching tubes will be fitted.

An armoured belt of steel or compound metal, 45 centimetres in thickness over the vitals, will be carried right round the vessel. The depth of this armour will extend at least two metres. The decks will be protected with armour to an average thickness of 60 millimetres.

The speed will be not less than 18 knots with forced draught. The coal endurance will be equal to 4000 miles at 10 knots.

At the same time that the dockyards were directed to submit plans for this new armoured vessel, the designer of the original Brennus was called on to report how far it would be possible to utilise the work already performed on the ship, while adhering to the new design.

On the supposition that existing work can be utilised, it will be possible to employ 200,000 days' work on this new vessel in the course of the year 1888. Should it, however, be found necessary to commence afresh, there will be a further delay of about six months.

The cost of the Brennus will not be less than the Hoche, or, from £760,000 to £800,000.

Extracts from Report of French Commission—continued.

TORPEDO FLOTILLA.

The Report for the year 1887 promised—

9 sea-going torpedo boats;
18 torpedo boats, first-class;
41 „ second-class;
9 torpedo vedettes.

This programme will not be realised. Five sea-going torpedo boats only have been admitted into the service, the other four requiring alterations.

Two out of the seven torpedo vedettes have been accepted.

The number of first-class torpedo boats has been reduced to seventeen by the loss of No. 67, three only having been added in the course of the year.

The reason for the delay is that fifty torpedo boats were ordered at once, without awaiting the instruction that experience alone can give. The result is that the greater number must be altered to enable them to fulfil the conditions which are now regarded as essential. We believe that these alterations will be far advanced during the first three months of 1888. We shall then have, in addition to the sea-going torpedo vessels, about 120 torpedo boats in the first and second classes.

The present Minister of Marine has given an order for four torpedo boats of different types. We trust he will await experiments before giving further orders.

Ships in commission.

The following Table shows the appropriation of money and men to the various Naval Services:—

—	Expenditure.	Effective.	
		Officers.	Crews.
	£		
Squadron of Instruction, at the Foreign Stations, and at the Home Ports.	1,099,680	594	10,809
Coast Defence Service	191,430	81	1,750
Vessels on Trials	189,320	50	1,284
Colonial Defence Service	228,780	123	2,384
Transports	94,600	66	1,407
Schools	370,860	234	6,427
Minor Ports and Protection of Fisheries	91,540	69	1,289
Hydrographical Service	7,930	10	75
Totals	£2,274,140	1,227	25,425

Extracts from Report of French Commission—continued.

DISTRIBUTION OF FLEET.

The ships will be distributed as follows:

Squadron of Evolutions	4 Armoured battleships.	
	1 Cruiser, 2nd Class.	
	2 Armoured battleships.	To be in commission for 3 months during grand manœuvres.
	1 Cruiser, 3rd Class.	
	1 Torpedo cruiser.	
	1 Torpedo aviso.	
Naval Division, Cochin China	2 Avisos.	
	1 Gunboat.	
Do. Levant	1 Armoured cruiser.	
	1 Cruiser, 2nd Class.	
	1 Aviso.	
	1 Gunboat.	
Do. Senegal and Guinea	6 Avisos, 2nd Class.	
Naval Station, Congo and Gabon	2 Avisos.	
	1 Aviso transport.	
Transport Service	3 1st Class, for India and China.	
	2 2nd Class, New Caledonia.	
	1 „ Guiana.	
	1 3rd Class, Senegal and Gabon.	
	3 3rd Class, for service of the Ports.	

COAST DEFENCE.

	Seagoing Torpedo Boats.	Torpedo Boat, 1st Class.	Torpedo Boat, 2nd Class.
Cherbourg	1	2	3
Brest	1	2	3
Lorient	1	1	2
Rochefort	..	1	1
Toulon	1	6	3

Extracts from Report of French Commission—continued.

PERSONNEL.

The total number of officers and men provided for in estimates for 1888 is as follows:—

	On Shore.	Afloat.	Reserve.	Total.
Vice-Admirals	17	1	..	18
Rear-Admirals	24	6	..	30
Post Captains	62	35	3	100
Captains of Frigates	126	63	13	202
Lieutenants	285	405	34	724
Ensigns	193	227	..	420
Naval Cadets	..	297	..	297
Engineers in Chief	65	56	23	144
Crews	4,952	25,692	2,475	33,119
Total Officers and Seamen	5,724	26,782	2,548	35,054
Constructive and Scientific, &c., Staff	190	2	..	192
Hydrographical Staff	12	6	..	18
Commissariat Staff	305	86	5	396
Medical Officers	405	132	7	544
Chaplains	13	16	..	29
Total	925	242	12	1,179
Adjutants. for Torpedo Service	26	..	..	26
Pensioners „ „	2,076	..	..	2,076
Total	2,102	..	..	2,102

TROOPS.

	For Service in France.	For Service in the Colonies.	Total.
MARINE INFANTRY.			
Officers	474	249	723
Non-commissioned Officers and Privates	13,607	7,243	20,850
MARINE ARTILLERY.			
Officers	366	68	434
Non-commissioned Officers and Privates	4,222	1,898	6,120
NAVAL POLICE.			
Officers	18	..	18
Men	601	..	601
	19,288	9,458	28,746

Extracts from Report of French Commission—continued.

RECAPITULATION showing numbers provided for in French Navy Estimates, 1888.

Naval Officers and Seamen	35,054
Civilian branches of Naval Service	1,179
Pensioners for Torpedo Service	2,102
Troops, Marine Infantry	21,573
„ „ Artillery	6,554
„ Naval Police	619
Total	67,081

In addition to the above, 2252 officers and men are paid out of the funds of the Protectorate of Tonkin.

COMPARATIVE STATEMENT showing Number of MEN borne on FRENCH, ENGLISH, and GERMAN VESSELS.

FRANCE.

Name of Ship.	Date of Commission.	Displacement.	Horse-Power.	Number of Guns.	Complement.
Colbert	1875	8,900	4,800	16	743
Trident	1876	8,900	4,800	16	727
Richelieu	1873	9,100	4,400	19	720
Redoutable	1876	9,200	6,000	14	706
Ocean	1868	7,700	4,000	16	683
Devastation	1879	10,500	6,000	14	682
Marengo	1869	7,900	4,000	15	680
Friedland	1873	9,100	4,000	16	679
Suffren	1870	7,800	4,000	14	672
Courbet	1885	9,700	6,000	14	666
Amiral Duperré	1879	11,100	6,000	19	662

ENGLAND.

Name of Ship.	Date of Commission.	Displacement.	Horse-Power.	Number of Guns.	Complement.
Temeraire	1876	8,500	7,700	8	534
Ajax	1880	8,510	6,440	6	400
Thunderer	1872	9,330	6,270	4	400
Agamemnon	1879	8,510	6,360	4	380
Devastation	1871	9,330	6,650	4	372
Colossus	1882	9,150	7,490	9	325
Neptune	1874	9,330	8,000	6	237
Agincourt*	1865	10,690	6,870	17	705
Alexandra	1875	9,490	8,610	12	671
Bellerophon	1865	7,750	6,520	14	663
Audacious	1869	6,110	4,830	14	450
Hercules	1868	8,680	6,750	14	340
Invincible	1869	6,010	4,830	14	327
Belleisle	1876	4,870	3,200	4	180

* Flag Ship.

Extracts from Report of French Commission—continued.

GERMANY.

Name of Ship.	Date of Commission.	Displacement.	Horse-Power.	Number of Guns.	Complement.
Konig Wilhelm	1868	9,557	8,000	29	759
Kaiser	1874	7,676	8,000	15	638
Deutschland	1874	7,676	8,000	15	638
Friedrich der Grosse	1874	6,770	5,400	6	537
Preussen	1873	6,770	5,400	6	537
Friedrich Carl	1867	6,007	3,500	16	531
Kronprinz	1867	5,568	4,800	16	537
Bayern	1878	7,400	5,600	6	354
Sachsen	1877	7,400	5,600	6	354
Wurtemberg	1878	7,400	5,600	6	354
Baden	1880	7,400	5,600	6	354

The complements of the French armourclads are doubtless excessive in time of peace, and should be reduced to the same proportions as the German and English. We could then have a larger number of ships ready for an emergency without any increase in the expense of the Personnel.

TABLE showing the value of STORES authorized to be maintained during the Year 1888.

Service.	Maximum.	Minimum.
	£	£
Naval Construction, Stores for the Fleet, Maintenance, and General Service	2,024,000	1,402,000
New Construction, Timber, exceptional purchase	600,000	400,000
Artillery, Arms, Powder, and Ammunition	1,200,000	800,000
Torpedoes	160,000	80,000
Hydraulic Works and Buildings	60,000	40,000
Clothing	720,000	520,000
Provisions	400,000	280,000
Barracks	120,000	60,000
Stores for Medical, Scientific, and Religious Services	88,000	68,000
Plant and General Service for the Ports and Arsenals	132,000	80,000
Furniture	24,000	14,000
	£5,528,000	£3,744,000

PROVISION IS MADE IN FRENCH ESTIMATES, 1887, FOR CONSTRUCTION OF THE FOLLOWING SHIPS.

Name of Ship.	Description.	Displacement.	Speed.	Estimated Cost of Hull and Machinery.	Sum provided in 1887.	Estimated State of Ship in Hundreds.		Where Building.
						1st Jan. 1887.	1st Jan. 1888.	
ARMOURED SHIPS:		Tonnage.	Knots.	£	£			
Amiral Baudin	Armourclad	11,380	15·0	548,800	85,760	80	complete	Brest.
Neptune	Ditto	10,581	15·0	520,000	109,600	51	67	Ditto.
Formidable	Ditto	11,380	15·0	529,800	79,920	79	97	Lorient.
Hoche	Ditto	10,581	15·0	528,000	73,200	33	51	Toulon.
Marçeau	Ditto	10,581	15·0	501,640	88,164	73	93	Société de la Méditerranée.
Magenta	Ditto	10,581	15·0	528,000	73,440	33	51	Toulon.
Cocyte	Armoured gun-boat, 1st class	1,639	13.0	89,200	12,800	80	complete	Cherbourg.
Phlégéton	Ditto ditto	1,639	13·0	89,200	26,860	49	89	Ditto.
Styx	Ditto ditto	1,639	13·0	89,200	28,120	27	67	Ditto.
Grenade	Ditto 2nd class	1,045	13·0	64,000	11,232	74	complete	Lorient.
PROTECTED SHIPS:								
Tage	Deck-protected cruiser	7,045	19·0	350,000	84,400	25	45	Société de la Loire.
Cécille	Ditto ditto	5,766	19·0	293,600	78,492	15	45	Société de la Méditerranée.
UNARMOURED SHIPS:								
Jean Bart	Cruiser, 1st class	..	..	186,400	13,104	1	7	Cherbourg.
Alger	Ditto ditto	..	..	186,400	35,896	1	20	Brest.
Isly	Ditto ditto	..	..	186,400	65,552	1	4	Rochefort.
Davoust	Ditto 2nd class	..	..	154,400	14,376	1	10	Brest.
Suchet	Ditto ditto	..	..	154,400	29,816	..	19	Toulon.
Surcouf	Ditto 3rd class	1,850	19·5	113,600	36,400	13	53	Cherbourg.
Fourbin	Ditto ditto	1,850	19·5	113,600	36,400	9	13	Rochefort.
Tronde	Ditto ditto	1,850	19·5	113,600	29,040	9	38	Société de la Gironde.
Epervier	Torpedo cruiser	1,280	17·0	84,800	14,000	65	complete	Rochefort.
Faucon	Ditto ditto	1,280	17·0	84,800	8,400	79	ditto	Toulon.
Vautour	Ditto ditto	1,280	17·0	84,800	12,800	68	ditto	Ditto.
Fulton	Aviso, 1st class	810	13·0	28,720	5,940	73	ditto	Lorient.
N.	Ditto ditto	810	13·0	28,720	9,728	..	32	Ditto.
Jouffroy	Ditto for river service	310	..	14,544	2,160	82	complete	Ditto.
Manche	Aviso-transport	1,580	10·5	49,800	18,352	27	67	Cherbourg.
Rance	Ditto ditto	1,580	10·5	49,800	9,600	76	complete	Lorient.
Vaucluse	Ditto ditto	1,580	10·5	49,800	27,320	28	84	Rochefort.

PROVISION IS MADE IN FRENCH ESTIMATES, 1887, FOR CONSTRUCTION OF THE FOLLOWING SHIPS—*continued.*

Name of Ship.	Description.	Length.	Speed.	Estimated Cost of Hull and Machinery.	Sum provided in 1887.	Estimated State of Ship in Hundreds.		Where Building.
						1st Jan. 1887.	1st Jan. 1888.	
			Knots.	£	£			
Ouragan	Torpedo-boat . .	133	..	18,000	14,000	24	complete	Société de la Loire.
Nos. 74 to 80	Fifty-one 1st class torpedo-boats for coast defence . .	108 to 114	..	42,120	1,265	95	ditto	Ditto.
Nos. 80 „ 86			..	42,120	1,265	95	ditto	Société Claparède.
Nos. 86 „ 92			..	42,120	1,265	95	ditto	Société Cail.
Nos. 92 „ 98			..	42,120	1,265	95	ditto	Schneider et Cie.
Nos. 98 „ 104			..	42,120	1,265	95	ditto	Société de la Mediterranée.
Nos. 104 „ 114			..	69,400	44,440	40	ditto	Ditto.
Nos. 114 „ 120			..	41,640	20,820	50	ditto	Société de la Gironde.
Nos. 120 „ 125			..	34,700	13,880	60	ditto	Schneider et Cie.
Drome	Transport, 3rd class	..	..	29,800	5,200	80	ditto	Société Claparède.
Andromède	Sailing frigate . .	..	..	48,000	12,480	41	67	Lorient.
Melpomène	Ditto ditto . .	..	..	48,000	12,000	75	complete	Rochefort.

ABSTRACT of AMOUNTS PROVIDED in FRENCH NAVY ESTIMATES for 1887 for SHIPS BUILDING in DOCKYARDS and by CONTRACT.

Description.	Number of Ships.	Hull.	Machinery.	Total Cost.
		£	£	£
Armourclads	6	440,320	69,764	510,084
Armoured gunboats	4	75,232	3,780	79,012
Deck-protected cruisers . . .	2	94,492	68,400	162,892
Cruisers 1st class	3	38,752	16,800	55,552
2nd „	2	29,792	14,400	44,192
3rd „	3	74,720	27,120	101,840
Torpedo cruisers	3	17,600	17,600	35,200
Avisos, 1st and 2nd class . . .	3	15,140	2,688	17,828
Aviso-transports	3	48,000	6,272	54,272
Torpedo boats	51	59,868	39,600	99,468
Transport, 3rd class	1	4,440	760	5,200
Sailing Frigates	2	24,480	..	24,480
	83	922,836	267,184	1,190,020
Extraordinary Estimate for construction of 9 cruisers, 8 eclaireurs, and 24 torpedo boats (see p. 659)	..	..	..	1,040,000
Supplementary Estimate for arrears due to contractors (see p. 639) .	..	..	..	280,000
	83	£922,836	£267,184	£2,510,020

PROVISION is made in FRENCH ESTIMATES, 1888, for CONSTRUCTION of the following SHIPS building in STATE DOCKYARDS. (For Vessels building by Contract, see page 675).

Name	Class.	Displacement.	Speed.	When Laid Down.	Total Estimated Cost of Hull Machinery and Armament.	Estimated State of Ship in Hundreds.		Amount provided in 1888 for Labour on Hull, Machinery, and Armament.*	Where Building.	
						Jan. 1, 1888.	Jan. 1, 1889.		Hull.	Engines.
		Tons.	Knots		£			£		
ARMOURED SHIPS:										
Amiral Baudin . .	Armourclad .	11,380	15·0	Dec. 1878 .	760,960	93	Complete	10,560	Brest .	Le Creusot.
Formidable . .	" .	11,380	15·0	Dec. 1878 .	768,800	93	Complete	11,350	Lorient .	Le Creusot.
Neptune . . .	" .	10,581	15·0	Oct. 1880 .	755,960	50	68	29,040	Brest .	Indret.
Hoche . . .	" .	10,581	15·0	Aug. 1880 .	775,520	70	93	39,600	Lorient .	Indret.
Magenta . . .	" .	..	..	Oct. 1880 .	760,960	48	65	24,700	Toulon .	Le Creusot.
Brennus . . .	" .	..	..	Commencement of 1888 .	775,520	..	..	26,400	Lorient .	Le Creusot.
Cocyte . . .	Armoured gun-boat, 1st class	1,639	13·0	Aug. 1882 .	179,240	79	Complete	6,732	Cherbourg	Saint Denis Claparède.
Phlégéton . .	" "	1,639	13·0	Aug. 1882 .	178,840	25	49	11,220	Cherbourg	Saint Denis Claparède.
Styx . . .	" "	1,639	13·0	Aug. 1882 .	178,840	12	41	12,800	Cherbourg	Saint Denis Claparède.
Grenade . . .	" 2nd class	1,015	13·0	Aug. 1882 .	84,040	78	Complete	5,800	Lorient .	Le Creusot.
Dupuy de Lôme .	Armoured Cruiser	..	20·0	Commencement of 1888 .	400,000	..	..	6,600	Brest	..

UNARMOURED SHIPS:										
Jean Bart . .	1st-class Cruiser	..	..	Sept. 1886 .	259,240	11	51	25,130	Rochefort	Indret.
Alger . . .	” ”	..	..	March 1887 .	259,240	7	24	15,840*	Cherbourg	Le Creusot.
Isly	” ”	..	..	March 1887 .	259,240	16	51	23,080*	Brest .	Indret.
Davoust . . .	2nd-class Cruiser	..	..	March 1887 .	194,120	16	50	19,140	Toulon .	Indret.
Suchet . . .	” ”	..	..	March 1887 .	194,120	16	50	19,270	Toulon .	Indret.
Surcouf . . .	3rd-class Cruiser	1,850	19·5	April 1886 .	125,280	82	Complete	6,200	Cherbourg	St. Denis Société de la Loire.
Forbin . . .	” ”	1,850	19·5	April 1886 .	125,280	67	Complete	11,620	Rochefort	St. Denis Société de la la Loire.
Vautour . . .	Torpedo Cruiser	1,280	17·0	Aug. 1882 .	89,520	60	Complete	10,280	Toulon .	La Seyne.
Manche . . .	Aviso Transport	1,580	10·5	Jan. 1885 .	57,680	32	44	2,640	Cherbourg	Indret.
Rance . . .	.. ..	1,580	10·5	May 1883 .	57,680	84	Complete	3,430	Lorient .	Indret.
Vaucluse . . .	.. ..	1,580	10·5	Sept. 1885 .	57,680	34	94	12,800	Rochefort	Indret.
Andromède . .	Sailing Frigate	..	..	Aug. 1882 .	56,120	47	77	4,490	Lorient .	..
Melpomène . .	” ”	..	..	Aug. 1882 .	56,120	88	Complete	2,380	Rochefort	..
		CONTRACT VESSELS COMPLETING IN STATE DOCKYARDS.								
Requin . . .	Armourclad .	..	..	.. ..	541,000	..	Almost Complete	9,700	Completing at Brest after delivery by Société de la Gironde.	
Tage . . .	Protected Cruiser	..	..	.. ..	385,200	..	Complete	1,980	Completing at Brest after delivery by Société de la Loire.	
Cécille . . .	” ”	..	..	.. ..	328,800	..	Almost Complete	1,980	Completing at Toulon after delivery by Société de la Mediterranée.	

* To be met out of Extraordinary Estimate.

ABSTRACT showing EXPENDITURE on account of LABOUR and MATERIALS in the ARSENALS and NAVAL ESTABLISHMENTS for the YEAR 1888.

—	Ordinary Estimate.	Extraordinary Estimate.	Total.
	£	£	£
LABOUR.			
Armourclads	141,640	..	141,640
Armoured gunboats	36,560	..	36,560
Armoured cruiser	6,600	..	6,600
" " 1st class	26,130	38,940	65,070
Cruisers, 2nd class	38,410	..	38,410
" 3rd class	17,820	..	17,820
Torpedo cruiser	10,300	..	10,300
Aviso transports	18,880	..	18,880
Sailing frigates	6,860	..	6,860
Manufacture of material for first armament	50,780	1,050	51,830
Completion of contract ships	13,660	..	13,660
	367,640	39,990	407,630
MATERIALS.			
Stores for vessels building in dockyards .	463,180	134,860	598,040
Total Stores and Labour for ships building in State dockyards	£830,820	£174,850	£1,005,670

PROVISION has been made in FRENCH ESTIMATES for 1888 for the following VESSELS BUILDING by CONTRACT.

Name.	Class.	Displacement.	Speed.	Where Building.	Date when commenced.	Estimated cost of Hull, Machinery and Armament.	Estimated state of Ship in Hundreds.		Amount provided in Estimates, 1888.
							1 Jan. 1888.	1 Jan. 1889.	
		Tons.	Knots.			£			£
Marçeau . . .	Armourclad	..	..	Société de la Mediterranée, La Seyne	Dec. 1880	767,640	87	96	65,500
Tage . . .	Protected cruiser	7,045	19	Soc. de la Loire, Saint Nazaire	Aug. 1885	385,200	68	Complete	85,200
Cecille . . .	" "	5,766	19	Mediterranée, La Seyne	Nov. 1885	331,800	71	91	68,000
Tronde . . .	3rd-class Cruiser	..	..	Soc. do la Gironde, Bordeaux	Aug. 1886	125,280	72	Complete	32,000
Lalande . . .	" "	..	..	Ditto Ditto	Mar. 1887	128,880	32	83	62,400*
Cosmao . . .	" "	..	..	Ditto Ditto	April 1887	128,880	32	83	62,400*
Coëtlogon . . .	" "	..	..	Cie. Gen. Transatlantic, Penhoet	May 1887	124,680	25	87	75,000*
Bengali . . .	2nd-class Aviso	..	..	A. Normand, Havre	June 1886	25,720	67	Complete	4,320
Lézard . . .	3rd " "	..	..	Cail, Paris	Aug. 1885	6,460	100	Ditto	2,760
Cigogne . . .	" "	..	..	Ditto	Aug. 1885	6,460	100	Ditto	920
Sainte Barbe . .	Torpedo Aviso	..	..	Claparede, St. Denis	Aug. 1883	37,110	100	Ditto	6,600
Salve . . .	" "	..	..	Ditto	Aug. 1883	87,110	100	Ditto	6,600
Drôme . . .	1st class Transport	..	..	Claparede, Rouen	Dec. 1885	6,460	100	Ditto	5,000
Ouragan . . .	Swift Torpedo Scout	..	..	Société de la Loire, Saint Nazaire	Aug. 1886	22,610	100	Ditto	4,000
N.	" "	..	..	Thornycroft, London	Aug. 1887	18,640	25	Ditto	13,500*
N.	" "	..	..	A. Norman, Havre	Contract not yet completed	20,640	25	99	15,000*
Torpedo boats . .	75 to 86, inclusive	..	..	Société de la Loire	June 1885	84,240	100	Complete	19,440
" " . .	87 to 92	..	..	Société Cail	June 1885	42,120	100	Ditto	9,720
" " . .	93 to 98, and 124 to 125	..	..	Schneider and Co.	June 1885	76,820	100	Ditto	19,220
" " . .	101 to 114	..	..	Société de la Mediterranée	June 1885	94,480	100	Ditto	18,610
" " . .	115 to 120	..	..	Société de la Gironde	Feb. 1886	41,640	100	Ditto	9,240
" " . .	126 and 127	..	..	A. Norman, Havre	Sept. 1887	26,160	26	Ditto	19,360*

* Extraordinary estimate.

PROVISION has also been made made in the CONTRACT VOTE for the PURCHASE of MACHINERY for the following VESSELS, the HULLS of which are BUILDING in the STATE DOCKYARDS.

Name of Vessel.	Class.	Contractors for Machinery.	Total Cost of Machinery.	Amount Provided in 1888.	—
			£	£	
Formidable .	Armourclad .	Le Creusot .	87,840	12,400	To complete payment.
Magenta . .	Do.	Do. .	125,000	22,460	Do.
Brennus . .	Do.	..	Not known	20,000	..
Cocyte . .	Armoured Gun-boat . . .	Claparede, St. Dennis .	19,400	..	Complete.
Phlégéton .	Do.	Do.	19,400	..	Do.
Styx . . .	Do.	Do.	19,400	..	Do.
Grenade . .	Do.	Le Creusot .	15,080	3,720	To complete payment.
Dupuy de Lôme	Armoured Cruiser	..	..	20,000	..
Alger . . .	1st class Cruiser	Le Creusot .	88,000	26,000	To advance to 43/100.
Forbin . .	3rd „ „	Soc. de la Loire	44,400	14,800	To complete payment.
Surcouf . .	3rd „ „	Do.	44,400	14,800	
Vautour . .	Torpedo Cruiser	La Sèyne .	34,000	5,600	Do.

RECAPITULATION—CONTRACT VOTE.

PURCHASE of CONTRACT-BUILT SHIPS, and of ENGINES for SHIPS BUILDING in STATE DOCKYARDS.

—	Hulls and Machinery for Ships building by Contract. Ordinary Estimate.	Machinery for Ships building in State Dockyards. Ordinary Estimate.	Hulls and Machinery for Ships building by Contract. Extraordinary Estimate.	Total.
	£	£	£	£
Armourclad Battleships . .	65,510	54,880	—	120,390
Armoured Gunboats . . .	..	3,720	—	3,720
Protected Cruiser . . .	153,200	—	—	153,200
Steel Cruiser	..	20,000	—	20,000
Cruisers, 1st class	..	..	26,000	26,000
„ 3rd „	32,000	29,600	199,800	261,400
Torpedo Cruiser	..	5,600	—	5,600
Avisos, 2nd class	7,320	—	—	7,320
„ 3rd class	3,680	—	—	3,680
Torpedo Aviso	9,200	—	—	9,200
Transport, 3rd class	5,000	—	—	5,000
Swift Torpedo Scouts	4,000	..	28,500	32,500
Torpedo Boats	76,230	..	19,360	95,590
Sundries	43,860	32,000	24,000	99,860
Totals . .	£400,000	£145,800	£297,460	£843,460

RECAPITULATION, showing AMOUNTS PROVIDED in 1888 for HULLS and MACHINERY of VESSELS BUILDING in STATE DOCKYARDS and by CONTRACT.

	£
Wages on vessels building in dockyards	407,630
Stores for ditto	598,040
Hulls and Machinery, ships building by contract	697,460
Machinery for ships building in dockyards	145,800
Total Amount for New Construction	£1,848,930

LIST of SHIPS AUTHORIZED to be ADVANCED or COMMENCED during the Year 1888.

Class.	Number.	Names of Vessels.
Armoured Battleships	8	Neptune, Formidable, Hoche, Magenta, Amiral Baudin, Brennus, Requin, Marçeau.
Armoured Gunboats	4	Cocyte, Phlégéton, Styx, Grenade.
Armoured Cruiser	1	Dupuy de Lôme.
Cruisers	2	Tage, Cécille.
Cruisers, 1st class	3	Jean Bart, Alger, Isly.
„ 2nd „	2	Davoust, Suchet.
„ 3rd „	6	Surcouf, Forbin, Tronde, Laland, Cosmao, Coëtlogon.
Torpedo Cruiser	1	Vautour.
Avisos	3	Bengali, Lézard, Cigogne.
Torpedo Avisos	2	Sainte Barbe, Salve.
Torpedo Eclaireurs	3	Ouragan, N., N.
Torpedo Boats	51	Nos. 75–88, 101–129.
Transport Avisos	3	Manche, Rance, Vaucluse.
Transport	1	Drôme.
Sailing Frigates	2	Andromède, Melpomène.

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[illegible]de, St. [illegible]is	19,400	.	
	19,400	..	
	19,400	..	Do.
	15,080	3,720	To complete payment.
..		20,000	..
	[illegible]	26,000	To advance to [illegible]
		14,800	To complete payment.
		14,800	
		5,600	Do.

OTE.

Ships

Total.
£
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7,[illegible]
[illegible]
9,[illegible]
5,[illegible]
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[illegible]
[illegible]

THE ARMOURED AND UNARMOURED FIGHTING SHIPS OF FRANCE LAID DOWN TO BUILD SINCE 1880.

ARMOURED SHIPS.			UNARMOURED SHIPS.		
Ship's Name.	Type.	Displacement in Tons.	Ship's Name.	Type.	Displacement in Tons.
			1880.		
Nil.	Nil.	Nil.	Dubourdieu	Cruiser	3,300
			Scorff	Despatch transport	1,570
			Capricorne	Gunboat	475
			Sagittaire	„	445
			Albatros	Paddle despatch boat	575
			Pluvier	Paddle despatch boat	540
			Oyapock	Paddle despatch boat	205
			Ecureuil	Paddle despatch boat	325
			Chimère	Screw despatch boat	260
			1881.		
Hoche	1st Class fighting ship	10,470	Milan	Cruiser	1,520
			Volage	Screw despatch boat	500
			Comète	Gunboat	475
			Météore	„	475
			Alouette	Paddle despatch boat	450
			Eclair	Paddle gunboat	195
			Trombe	„ „	195
			1882.		
Marçeau	1st Class fighting ship	10,400	Sfax	Deck protected Cruiser	4,430
Neptune	1st Class fighting ship	10,400	Inconstant	Despatch vessel	810
			Fulton	„ „	810
			Papin	„ „	810
			Durance	Despatch transport	1,570
			Meurthe	Despatch transport	1,570
			Lion	Gunboat	475
			Scorpion	„	475
			Etoile	„	440
			Gabes	„	475
			Vigilant	Paddle despatch boat	980
			Brandon	Paddle despatch boat	560

THE ARMOURED AND UNARMOURED FIGHTING SHIPS OF FRANCE LAID DOWN SINCE 1880—*continued.*

ARMOURED SHIPS.			UNARMOURED SHIPS.		
Ship's Name.	**Type.**	**Displacement in Tons.**	**Ship's Name.**	**Type.**	**Displacement in Tons.**
1882—(*continued*).					
			Ardent	Paddle despatch boat	560
			Mésange	Paddle despatch boat	565
			Ibis	Screw despatch boat	250
			Golland	Paddle despatch boat	595
			Héron	Paddle despatch boat	595
1883.					
Magenta	1st Class fighting ship	10,400	Condor	Torpedo vessel	1,270
Acheron	1st Class gunboat	1,610	Epervier	,, ,,	1,270
Cocyte	,, ,,	1,610	Bombe	Torpedo despatch boat	316
Flamme	2nd Class gunboat	1,030	Dague	Torpedo despatch boat	316
Fusée	,, ,,	1,030	Flèche	Torpedo despatch boat	316
Grenade	,, ,,	1,030	Sainte-Barbe	Torpedo despatch boat	316
			Couleuvrine	Torpedo despatch boat	316
			Dragonne	Torpedo despatch boat	316
			Lance	Torpedo despatch boat	316
			Salve	Torpedo despatch boat	316
			Jouffroy	Paddle despatch boat	305
			Alcyon	Paddle despatch boat	305
			Arquebuse	Screw gunboats	110
			Alerte		
			Avalanche		
			Bourrasque		
			Mutine		
			Rafale		
			Redoute		
			Tirailleuse		
			Henri-Rivière	Wheel gunboats for river service	125
			Garnier		
			Carreau		
			Berthe-de-Villers		
			Pionnier		
			Moulin		
			Jacquin		

THE ARMOURED AND UNARMOURED FIGHTING SHIPS, &c.—*continued.*

ARMOURED SHIPS.			UNARMOURED SHIPS.		
Ship's Name.	Type.	Displacement in Tons.	Ship's Name.	Type.	Displacement in Tons.
		1884.			
Phlégéton . .	1st class gunboat	1,610	Vautour . .	Torpedo vessel	1,270
Styx . .	,, ,,	1,610	Faucon . .	,, ,,	1,270
Mitraillo . .	2nd class gunboat	1,030	Aube . .	Despatch transport . .	1,560
			Eure . .	Despatch transport . .	1,560
			Rance . .	Despatch transport . .	1,560
			Salamandre .	Paddle despatch boat . .	295
			Pingouin . .	Paddle despatch boat . .	295
			Baïonnette . Casse-Tete . Caronade . . Cimeterre . . Estoc . . Bouclier . .	Screw gunboats "Arquebuse" type . .	110
		1885.			
	Nil		Amiral Cécille .	Deck Protected Criuser .	5,080
			Tage . .	Deck Protected Cruiser .	7,045
			Sirius . .	Screw gunboat	465
			Manche . .	Aviso transport	
			Vaucluse . .	Aviso transport	
			Lézard . .	3rd class aviso	
			Cigogne . .	3rd class aviso	
		1886.			
	Nil		Jean Bart. .	1st class cruiser	
			Surcouf . .	3rd class cruiser	1,850
			Tronde . .	3rd class cruiser	1,850
			Bengali . .	2nd class aviso	
			Ouragan . .	Torpedo scout .	130 ft.
		1887.			
			Alger . .	1st class cruiser	
			Isly . . .	1st class cruiser	
			Davout . .	2nd class cruiser	
			Suchet . .	2nd class cruiser	
			Lalande . .	3rd class cruiser	
			Cosmao . .	3rd class cruiser	
			Coëtlogon . .	3rd class cruiser	
			N . . .	Torpedo scout	

(For corresponding Table of Fighting Ships of England laid down since 1880, see pp. 557, 558.)

ABSTRACT OF FRENCH NAVY

		1876.	1877.	1878.	1879.
		£	£	£	£
1	Central Administration	53,044	53,044	52,192	55,484
2	Hydrographic Office	19,784	19,784	22,404	20,732
3	Officers and Seamen afloat and ashore	1,622,484	1,622,478	1,745,332	1,775,450
4	Barracks for Seamen				
5	Naval School				
6	Troops	579,348	543,556	556,672	547,912
7	Maritime Gendarmerie				
8	Barracks for Troops				
9	Dockyard and other Civilian Officers and Staff	159,456	160,408	177,584	185,944
10	Leading Men, Police, Firemen, &c.	103,312	102,760	106,052	106,320
11	Provisions	958,448	928,100	962,552	982,300
12	Hospitals				
13	Wages—	797,500	831,148	880,048	957,860
	Naval Construction. Manufacture of Stores	..	..	..	..
	New Constructions	..	..	..	..
	Repairs	..	..	..	..
	General Service	..	..	..	..
	Purchase of Stores, and Ships built by Contract	1,924,636	2,141,012	2,600,964	2,338,186
	Ships Building by Contract	..	..	..	..
14	Hydraulic Works and Buildings	229,512	359,568	392,060	409,332
15	Ordnance Stores and Wages *	..	..	..	..
16	Maritime Justice	10,376	10,376	9,456	9,456
17	Books and Printing	14,232	15,592	16,312	19,792
18	Travelling Expenses	..	..	..	..
19	Sundries	153,352	175,540	184,140	200,412
20	Secret Service	..	..	..	..
21	Maritime Inscription, Fisheries, &c.	..	..	..	..
	Grant to the "Caisse des Invalides"	..	..	..	..
		6,625,484	6,962,466	7,705,768	7,609,180
	Abate—Balance unexpended	58,376	91,636	101,128	262,688
		6,567,108	6,870,830	7,604,640	7,346,492

* Previous to 1882 included under sub-head 13.

ESTIMATES, FROM 1876 TO 1887.

1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
£	£	£	£	£	£	£	£
56,712	53,692	54,016	58,905	50,354	54,192	54,144	56,464
20,732	20,732	20,760	20,761	20,265	19,720	19,720	15,800
1,697,196	1,715,056	1,752,996	1,827,217	1,843,460	1,803,256	1,791,088	1,797,544
			8,305	8,072	5,968	5,968	5,968
			9,206	10,176	10,172	10,172	10,172
557,064	569,848	569,476	533,307	544,862	562,668	552,136	534,968
			38,333	38,333	38,332	37,244	37,244
			40,015	39,340	36,952	36,952	37,408
193,932	206,732	216,152	206,526	198,605	189,292	188,884	189,092
114,488	117,240	117,252	118,169	132,140	126,076	127,592	129,008
819,632	800,976	770,796	807,831	824,763	814,064	799,348	778,120
129,040	132,436	132,964	124,363	120,427	112,532	121,232	121,232
987,976	985,649	..	..	..	..	..	..
..	..	98,600	102,600	116,655	111,200	111,200	80,000
..	..	277,000	328,000	345,140	312,000	312,000	320,000
..	..	197,052	157,054	157,585	156,000	156,000	156,000
..	..	304,180	289,620	261,988	246,240	245,988	217,188
2,308,624	2,426,804	1,342,628	2,190,141	1,963,245	1,921,448	1,921,440	1,166,700
..	..	..	..	..	..	..	748,000
454,092	416,608	235,200	437,200	367,732	372,948	372,920	361,520
..	..	359,492	681,083	653,344	773,276	773,228	709,548
9,456	9,072	9,036	9,039	9,000	9,000	8,940	8,940
22,492	24,756	26,280	26,280	25,724	22,984	22,984	22,744
..	..	150,000	150,683	145,160	144,000	154,352	154,352
164,228	213,723	30,000	30,395	28,760	27,016	27,016	27,016
..	..	..	..	2,600	2,600	2,600	2,600
..	..	1,720	2,839	3,488	3,488	3,488	3,488
..	..	..	..	..	..	186,620	224,352
7,535,664	7,693,324	6,655,600	8,197,872	7,911,218	7,575,424	8,043,296	7,913,500
262·272	128·396	379,416	116,800	..	..	..	..
7,273,292	7,564,928	6,276,184	8,081,072	7,911,218	7,575,424	8,043,296	7,913,500
					Extraordinary Estimate		1,228,200
							9,141,700

The Estimate for 1887 was not finally voted in this form. See page 687. The figures have been inserted to enable a comparison to be made with previous years.

List of French Ships in Commission,

WITH THEIR STATIONS, ON 29TH OCTOBER, 1887.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Actif	Despatch boat	4	Muller, L. V.	Algiers.
Adour	Transport	—	Coulombeaud, C. V.	Div. Tonkin.
Africain	Hulk	—	Ferrat, C. F.	Sénégal.
Albatros	Despatch boat	2	Rathouis, L. V.	
Alceste	Sailing frigate	4	Gourgas, C. F.	Gabon.
Alcyon	Cutter	2	Deuve, L. V.	Granville.
Alerte	Gunboat	2	Dantin, L. V.	Tonkin.
Alouette	Despatch boat	3	Rihouët, L. V.	Saigon.
Amiral-Duperré	Ironclad	14	Vivielle, C. V.	Squadron.
Ardent	Despatch boat	2	Receveur, L. V.	
Aoraï	Schooner	2	Reux, L. V.	Tahiti.
Arethuse†	Cruiser	—	Escudier, C. V.	South Atlantic.
Ariège	Transport	—	De Faubournet de Montferrand, L. V.	Voyage au Sénégal, et au Gabon.
Arquebuse	Gunboat	6	Gaschard, L. V.	Tonkin.
Aspic	Gunboat	4	Rupé, L. V.	East Indies.
Austerlitz	Cadet school	4	De Kervereguin, C. V.	Brest.
Avalanche	River gunboat	—	Cadiou, L. V.	Tonkin.
Baïonnette	Gunboat	2	Jourden, L. V.	Cochinchina.
Basilic	Despatch boat	2	Meunier dit Joannet	Gabon.
Bombe	Despatch boat	—	St.-Sauveur Bougainville, L. V.	Cherbourg.
Borda	Naval school	—	Barréra, C. V.	Brest.
Bouclier	Gunboat	2	Faucon, L. V.	Cochinchina.
Bourrasque	Gunboat	2	Coantic, L. V.	Tonkin.
Bouvet	Despatch boat	4	De Brétizel, C. F.	Antilles.
Brandon	Despatch boat	2	Daniel, L. V.	Rentre à Cherbourg.
Bretagne	School for boys	—	Méquet, C. V.	Brest.
Caïman	Ironclad	—	Rallier du Baty C. V.	Toulon.
Calédonien	Transport	—	Cavalié, C. F.	Rentre à Brest.

* Extracted from *Journal de la Marine le Yacht*, 29th October, 1887.

† Flagship.

LIST OF FRENCH SHIPS IN COMMISSION *—*continued.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Caravane	Transport	4	Huau, L. V.	Coast of France.
Caronade	Gunboat	—	De Miniac, L. V.	Cochinchina.
Casse-Tête	Gunboat	2	Thomine, L. V.	Tonkin.
Chacal	Gunboat	2	Brion, L. V.	Indian Ocean.
Cigale	Despatch boat	6	De Rosières, L. V.	Sénégal.
Cigogne	Despatch boat	—	Sentis, L. V.	Cherbourg.
Colbert †	Ironclad	—	Courrejolles, C. V.	Squadron.
Coligny	Cruiser	—	Chassériau, C. F.	Cherbourg.
Comète	Gunboat	4	Martel, L. V.	Tonkin.
Condor	Cruiser	—	Lormier, C. F.	Squadron.
Corse	Despatch boat	4	Babeau, L. V.	Toulon.
Couleuvrine	Despatch boat	—	Chocheprat, L. V.	Squadron.
Courbet	Ironclad	8	De Maigret, C. V.	Squadron.
Couronne	Gunry. sch. ship	36	Gadaut, C. V.	Ecole des Canon.
Cuvier	Despatch boat	4	Pradier, C. F.	Granville.
Dayot	Cruiser	—	Daniel, C. F.	Indian Ocean.
Decrès	Cruiser	4	La Guerre, C. V.	Pacific.
D'Estaing	Cruiser	—	Michel, C. V.	Indian Ocean.
D'Estrées	Cruiser	—	Besson, C. F.	Tunis.
Dévastation†	Ironclad	14	Dieulouard, C. V.	Squadron.
Dives	Transport	2	Doze, L. V.	New Caledonia.
Dordogne	Transport	4	Moussu, L. V.	Diego-Suarez.
Duchaffault	Cruiser	6	Gourdon, C. F.	New Caledonia.
Du Couëdic	Cruiser	—	Boutet, C. F.	North Atlantic.
Duguay-Trouin	Cruiser	—	Escande, C. V.	Cherbourg.
Dumont d'Urville	Despatch boat	4	Parfait, C. F.	South Atlantic.
Duquesne†	Cruiser	21	Fournier, C. V.	Pacific.
Élan	Despatch boat	2	Houette, L. V.	School of Pilots.
Éperlan	Cutter	4	Vallée, L. V.	North Sea.
Estoc	Gunboat	2	Fontaine, L. V.	Tonkin.
Etendard	Gunboat	—	Servonnet, L.V.	Hyd. Corse.
Étoile	Gunboat	4	Berryer, L. V.	La Plata.
Fabert	Cruiser	8	Bénier, C. F.	Pacific.
Fanfare	Gunboat	2	Sauvan, L. V.	Cochinchina.
Framée	River gunboat	1	Bonifay, L. V.	Cochinchina.

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* Extracted from *Journal de la Marine le Yacht*, 29th October, 1887.

† Flagships.

LIST OF FRENCH SHIPS IN COMMISSION *—*continued.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Gabès	Gunboat	2	Chevalier, L. V.	South Atlantic.
Goeland	Despatch boat	2	Hiart, L. V.	Sénégal.
Guichen	Despatch boat	2	Le Pord, L. V.	Rentre a Toulon.
Henri Rivière	River gunboat	2	Lenormand, L. V.	Tonkin.
Héron	Despatch boat	2	Lecome, L. V.	Sénégal.
Hugon	Cruiser	6	. . . . . .	Atlantic.
Iphigénie	Cruiser	20	Rocomaure, C. V.	School Ship.
Isère	Transport	1	Goëz, L. V.	Coast of France.
Jacquin	Gunboat	2	Le Golleur, L. V.	Tonkin.
Jaguar	Gunboat	2	Adigard, L. V.	Cochinchina.
Japon	Trpdo. sch. ship	2	Chassériaud, C. F.	Toulon.
Javelot	River gunboat	2	Villegente, L. V.	Bidassoa.
Laprade	Despatch boat	2	Carradot, L. V.	Gabon.
Levrard	Gunboat	2	Le Prieur, L. V.	Tonkin.
Lion	Gunboat	4	Fort, L. V.	Tonkin.
Loire	Transport	—	Pougin de la Maisoneuve, C. V.	Cochinchina.
Loyalty	Despatch boat	2	Simon, L. V.	New Caledonia.
Lutin	Gunboat	4	Nény, L. V.	Tonkin.
Mésange	Despatch boat	2	Hallez, L. V.	Sénégal.
Météore	Gunboat	4	Germinet, L. V.	Levant.
Meurthe	Despatch boat	—	Richard-Foy, L. V.	Indian Ocean.
Milan	Cruiser	2	d'Hombres, C. F.	Squadron of Evolution.
Minerve†	Cruiser	—	Ménard, C. V.	North Atlantic.
Mouette	Despatch boat	4	De Bernhardières, C. F.	North Sea.
Moulun	Gunboat	2	Surcouf, L. V.	Tonkin.
Mutine	Gunboat	2	Clément, L. V.	Tonkin.
Nièvre	Despatch boat	4	Coffinières de Nordeck, L. V.	Tonkin.
Nu-hiva	Schooner	—	Leudet-Delavallée, L. V.	Marquesas.
Orne	Transport	—	Magnon-Pujo	Toulon.
Orohéna	Schooner	2	Clot, L. V.	Tahiti.
Oyapock	Despatch boat	2	Monge, L. V.	Guiana.

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* Extracted from *Journal de la Marine le Yacht*, 29th October, 1887. † Flagships.

List of French Ships in Commission *—*continued.*

Name of Ship.	Type.	Number of Guns.	Name and Rank of Commander.	Stations.
Parseval	Despatch boat	—	Foret, C. F.	East Indies.
Pétrel	Despatch boat	4	Pailhès, L. V.	Constantinople.
Pingouin	Despatch boat	—	Revert, 1st Maître	Obock.
Pluvier	Despatch boat	3	Bonifay, L. V.	Tonkin.
Pourvoyeur	Despatch boat	1	Daubenel, L. V.	Gabon.
Primauguet	Cruiser	15	Véron, C. V.	East Indies.
Provençale	Hulk	—	Chevalier, L. V.	Toulon.
Rafale	Gunboat	2	Meunier, L. V.	Tonkin.
Redoute	Gunboat	2	Ridoux, L. V.	Indian Ocean.
Résolue	Frigate	8	Gourdan, C. V.	Training ship.
Rollandes	Cruiser	15	Lapotaire, L. V.	Tonkin (s.).
Sagaie	Gunboat	2	Terlier, L. V.	Cochinchina.
Saint-Louis	Gunnery ship	36	Pillard, C. F.	Tender to Couronne.
Salamandre	Despatch boat	6	Muller, L. V.	Sénégal
Scorff	Transport	4	De Royer, de Saint-Julien, L. V.	Tahiti.
Scorpion	Gunboat	4	Andrieu, L. V.	Tahiti.
Shamrock	Transport	—	Peyronnet, C. F.	China.
Taravao	Schooner	—	Masseron, L. V.	Tahiti.
Tirailleuse	Gunboat	4	Texier, L. V.	Indian Ocean.
Travailleur	Despatch boat	4	Bonnefin, L. V.	Rochefort (station).
Trombe	Despatch boat	2	Andréani, L. V.	Tonkin.
Turenne †	Ironclad	13	Juge, C. V.	East Indies.
Vauban †	Armoured cruiser	12	Pottier, C. V.	Levant.
Vaudreuil	Cruiser	13	Vincenot, C. F.	Indian Ocean.
Vienne	Transport	—	Campion, L. V.	Coast of France.
Vigilant	Despatch boat	2	Lyon, L. V.	Guiana.
Vipère	Gunboat	4	De Marolles, L. V.	East Indies.
Volta	Cruiser	—	Jarrige, C. F.	New Caledonia.

* Extracted from *Journal de la Marine le Yacht*, 29th October, 1887. † Flagships.

STATEMENT SHOWING THE ACTUAL VALUE OF THE FRENCH FLEET, HULLS AND MACHINERY, ON THE 1ST JANUARY, 1887, AND 1ST JANUARY, 1888.

Name of Ship.	Estimated Value.	
	1 January, 1888.	1 January, 1887.
ARMOURCLADS.	£	£
Amiral Duperré	486,536	504,820
Courbet	471,364	486,400
Dévastation	396,200	411,240
Redoutable	315,012	328,497
Colbert	115,900	129,677
Friedland	181,612	181,985
Marengo	59,380	59,377
Océan	42,828	42,825
Richelieu	116,280	134,984
Suffren	61,376	72,685
Trident	148,204	164,068
Indomptable	416,384	429,680
Terrible	416,384	429,680
Caïman	416,384	429,680
Requin	429,680	—
Savoie	26,212	34,212
Revanche	38,704	38,704
Surveillante	..	21,336
Héroïne	72,516	72,510
Total value of Armourclads	4,210,956	3,972,600
ARMOURCLADS FOR COAST DEFENCE SERVICE.		
Fulminant	252,876	266,484
Furieux	303,452	303,449
Tonnere	187,812	196,224
Tempête	172,764	179,884
Tonnant	209,212	216,125
Vengeur	188,192	195,349
Bélier	21,576	27,845
Bouledogue	29,236	35,893
Cerbére	..	16,104
Taureau	..	13,297
Tigre	38,384	45,496
Total value of Armourclads for Coast-guard service	1,403,504	1,496,150
ARMOURED CRUISERS.		
Bayard	169,296	169,293
Duguesclin	237,000	244,560
Turrenne	203,656	217,789
Vauban	237,000	244,560
La Galissonnière	26,608	34,053
Triomphante	67,320	75,989
Victorieuse	76,308	76,144
Montcalm	8,904	15,097
Reine-Blanche	..	14,516
Thétis	9,544	16,164
Total value of Armoured Cruisers	1,035,636	1,108,170
ARMOURED GUN-BOATS.		
Achéron	65,200	65,200
Flamme	52,200	52,200
Fusée	52,200	52,200
Mitraille	52,200	52,200
Total value of Armoured Gun-boats	221,800	221,800
ARMOURED FLOATING BATTERY.		
Protectrice	17,280	17,280
Total value of Armoured Floating Battery	17,280	17,280
DECK-PROTECTED CRUISERS..		
Duquesne	160,416	167,248
Tourville	188,104	136,773
Sfax	153,036	153,036
Aréthuse	104,132	110,060
Dubourdieu	116,000	116,000
Iphigénie	91,632	97,552
Naïade	94,860	100,875
Flore	..	12,176
Minerve	12,088	12,085
Vénus	..	8,388
Clorinde	5,436	9,336
Total value of Deck-protected Cruisers	925,204	923,520
CRUISERS, 1st CLASS.		
Duguay-Trouin	83,356	87,420
D'Estaing	42,364	47,097
Forfait	50,232	49,417
Lapérouse	41,516	45,861
Magon	58,912	63,264
Primauguet	84,168	91,037
Nielly	49,648	53,952
Roland	67,320	71,933
Villars	43,208	43,208

ACTUAL VALUE OF THE FRENCH FLEET—*continued.*

Name of Ship.	Estimated Value. 1 January, 1888.	Estimated Value. 1 January, 1887.
	£	£
CRUISERS, 2nd CLASS.		
Champlain	16,156	19,076
Châteaurenault	12,056	12,053
Dupetit-Thouars	25,468	25,456
Fabert	21,404	24,257
Laclocheterie	14,652	17,312
Sane	9,960	12,772
Seignelay	25,948	25,948
Infernet	6,912	9,668
Decrès	6,080	8,461
Dupleix	..	7,164
Desaix	10,152	14,221
Eclaireur	31,664	14,988
Milan	69,000	71,322
Rigault de Genouilly	30,636	33,841
Rapide	11,052	11,052
CRUISERS, 3rd CLASS.		
Beautemps Beaupré	10,844	12,514
Bourayne	4,288	5,969
Dayot	6,176	6,176
D'Estrées	3,740	5,217
Duchauffaut	10,000	10,677
Ducouëdic	6,312	6,309
Hugon	9,700	11,473
Kerguelen	12,516	12,513
Limier	2,424	3,973
Segond	6,356	6,356
Talisman	7,736	7,736
Vandreuil	5,664	7,288
Volta	5,332	5,332
Hirondelle	7,264	10,145
Linois	5,192	7,221
Total value of Cruisers	915,668	979,680
TORPEDO CRUISER.		
Condor	79,624	84,800
Epervier	75,600	—
Total value of Torpedo Cruiser	155,224	84,800
AVISOS, 1st CLASS.		
Chasseur	16,884	18,492
Voltigeur	19,500	21,197
Bisson	14,292	14,292
Bouvet	14,752	16,308
Dumont d'Urville	21,532	21,528
Hussard	18,180	19,912
Labourdonnais	12,672	14,365
Parseval	19,888	19,888
Inconstant	29,776	29,773
Papin	29,776	29,773
Boursaint	8,816	8,813
Bruat	..	2,732
Guichen	1,736	2,841
Bourgainville	2,444	3,596
Vigilant	36,544	38,901
Travailleur	6,084	6,084

Name of Ship.	Estimated Value. 1 January, 1888.	Estimated Value. 1 January, 1887.
	£	£
AVISOS, 2nd CLASS.		
Volage	16,004	16,000
Corse	1,852	2,533
Actif	1,576	1,813
Cuvier	1,700	1,990
Elan	7,116	7,116
Ibis	8,500	8,785
Mouette	7,732	8,044
Chimère	10,012	10.553
Loyalty	2,400	2,605
Djoné	2,660	2,870
Olumo	..	3.497
Albatros	11,012	11,980
Héron	12,132	13,116
Goëland	13,232	13,232
Estafette	..	704
Pétrel	5,428	6,637
Alouette	15,696	16,780
Pluvier	17,468	18,765
Ardent	14,944	15,848
Brandon	14,944	15,848
Mésange	22,500	22,497
Magicien	1,744	—
Alcyon	15,600	15,600
Ecureuil	6,944	7,557
Cigale	4,100	4,592
Oyapock	4,200	4,592
Pingouin	8,388	9,016
Salamandre	8,388	9,016
Lézard	5,520	5,540
Cigogne	5,520	5,540
Basilic	3,392	3,800
Laprade	6,524	7,757
Gogah	1,020	1,456
Nagotna	..	4,257
Total value of Avisos and 2nd class	511,024	567,609
AVISO-TRANSPORTS.		
Allier	23,524	23,521
Aube	36,200	36,200
Dives	6,056	7,593
Drac	20,928	20,928
Durance	49,912	49,912
Eure	36,200	36,200
Indre	4,364	6,140
Meurthe	44,776	45,341
Nièvre	23,588	25,653
Pourvoyeur	17,136	18,769
Rance	49,912	49,912
Romanche	38,300	38,300
Saône	17,552	19,797
Scorff	39,676	42,249
Seudre	11,468	13,588
Vire	9,800	9,797
Total value of Aviso-Transports	£429,392	£443,900

ACTUAL VALUE OF THE FRENCH FLEET—*continued.*

Name of Ship.	Estimated Value. 1 January, 1888.	Estimated Value. 1 January, 1887.
	£	£
TORPEDO-AVISOS.		
Bombe	34,000	32,260
Couleuvrine	34,000	34,000
Dague	34,000	34,000
Dragonne	34,000	34,000
Flèche	34,000	34,000
Lance	34,000	34,000
Sainte-Barbe	34,000	34,000
Salve	34,000	34,000
Total value of Torpedo Avisos	272,000	270,260
GUN-BOATS.		
Aspic	11,408	12,816
Vipère	13,040	14,420
Sagittaire	11,204	12,177
Capricorne	15,252	15,249
Lion	17,228	18,272
Scorpion	17,228	18,272
Lionne	5,568	6,413
Lutin	9,680	7,568
Lynx	9,148	10,181
Etoile	18,672	19,316
Gabés	24,220	25,689
Comête	15,140	16,184
Météore	18,278	17,316
Crocodile	9,248	9,228
Chacal	1,520	2,132
Léopard	..	2,268
Hyène	..	2,296
Fanfare	1,664	2,336
SLOOP GUN-BOATS.		
Tromblon	8,056	8,449
Epée	4,616	4,865
Arquebuse	..	5,825
Alerte	..	5,825
Avalanche	..	5,825
Baïonnette	5,628	5,825
Bouclier	5,628	5,825
Bourrasque	..	5,825
Caronade	5,628	5,825
Casse-tête	..	5,825
Cimeterre	5,628	5,825
Estoc	..	5,825
Mutine	..	5,825
Rafale	..	5,825
Redoute	5,628	5,825
Tirailleuse	5,628	5,825
Eclair	..	6,177
Trombe	..	6,177
Berthe de Villers	7,128	7,892
Carreau	..	7,892
Garnier	..	7,892
Henry Rivière	..	7,892
Jacquin	..	7,892
Moulun	..	7,892
Pionnier	7,128	7,892
Bobillot	..	11,796
Biche	2,496	..
Bossant	..	11,796
Chamois	2,496	..
Cuvellier	..	11,796
Doucet	..	11,796
Levrard	..	11,796
Raynaud	..	11,796
Rollandes	..	11,796
8 others	..	6,132
Total value of Gun-boats	264,184	464,200
STEAM SLOOPS.		
Etincelle	348	377
Carpe	596	596
Mirmidon	528	576
Pygmée	528	576
Rubis	544	593
Turquoise	544	593
Abeille	800	849
Sentinelle	2,904	3,124
Nautile	3,120	3,340
Surveillant	2,044	1,324
Saphir	912	960
Licona	..	1,152
Total value of Steam Sloops	12,868	14,061
SEA-GOING TORPEDO BOATS.		
Balny	13,520	14,400
Challier	13,520	14,400
Capitaine Cuny	13,520	14,400
Capitaine Mehl	13,520	14,400
Dehorter	13,520	14,400
Deroulède	13,520	14,400
Doudart de Lagrée	13,520	14,400
Bouët Willaumez	13,520	14,400
Edmond Fontaine	13,520	14,400
Gabriel-Charmes	10,056	—
TORPEDO BOATS.		
18 Torpedoes, 1st Class	405,540	105,288
41 Torpedoes, 2nd Class	119,256	132,805
9 Torpedo vedettes	11,172	14,572
Total value of Torpedo flotilla	£667,704	£382,265

ACTUAL VALUE OF THE FRENCH FLEET—*continued.*

Name of Ship.	Estimated Value.	
	1 January, 1888.	1 January, 1887.
TRANSPORTS, 1st CLASS.	£	£
Algésiras . . .	8,824	17,364
Intrépide . . .	15,662	21,917
Annamite . . .	76,600	76,600
Bien-Hoa . . .	143,384	143,384
Gironde	151,892	151,892
Mytho	124,556	129,656
Nive	145,928	145,925
Shamrock . . .	134,488	134,488
Tonkin	115,216	120,129
Vinh-Long . . .	147,864	147,864
TRANSPORTS, 2nd CLASS.		
Corrèze	6,420	10,844
Creuse	6,452	10,901
Guerrière . . .	7,524	7,521
Sarthe	10,844	15,273
Tarn	11,016	15,464
Calédonien . . .	88,500	91,328
Magellan . . .	85,672	88,497
Européen . . .	11,716	13,088
Calvados	..	3,905
Garonne	10,776	10,773
Orne	8,100	11,393
Rhin	..	9,212
TRANSPORTS, 3rd CLASS.		
Adour	..	2,480
Ariège	20,404	20,400
Caravane . . .	29,948	31,281
Isère	14,288	14,284
Moselle	..	4,037
Vienne	10,300	10,300
Total value of Transports . .	1,386,376	1,460,200
SAILING VESSELS.		
Navarin	..	8,152
Fontenoy . . .	£4,592	£8,344

Name of Ship.	Estimated Value.	
	1 January, 1888.	1 January, 1887.
FRIGATES.	£	£
Isis	..	2,419
Resolue	10,244	10,241
CORVETTES.		
Favorite	2,140	3,801
Bayonnais . . .	5,400	5,400
Sylphe	5,400	5,400
TRANSPORT.		
Dordogne . . .	1,118	2,112
SLOOPS.		
Avraï	1,128	1,236
An-hiva	688	741
Orohéna	1,068	1,641
Perle	4,176	4,489
Taravas	744	797
CUTTERS.		
Alcyone	208	297
Eperlan	1,688	1,792
31 Boats for protection of Fisheries .	7,488	8,288
Total value of Sailing Ships . .	46,082	65,150
TRAINING SHIPS.		
Couronne . . .	48,776	55,364
Saint-Louis . . .	6,772	11,205
Japon	11,716	13,485
Messager. . . .	..	276
Total Value of Training Ships	£67,264	£80,330

ABSTRACT SHOWING VALUE OF THE FRENCH FLEET.

Class.	1 January, 1887.		1 January, 1888.	
	Number.	Value.	Number.	Value.
Armourclad squadron	18	£ 3,972,600	18	£ 4,210,000
„ coast defence service	11	1,496,150	9	1,403,504
Armoured cruisers	10	1,106,170	9	1,035,636
„ gunboats	4	221,800	4	221,800
„ floating battery	1	17,280	1	17,280
Deck-protected cruisers	11	923,520	9	925,204
Cruisers	39	979,680	38	915,668
Torpedo cruiser	1	84,800	2	155,224
Avisos	49	567,600	46	511,024
Aviso transports	16	443,900	16	429,392
Torpedo avisos	8	270,260	8	272,000
Gunboats	59	464,200	28	264,184
Steam sloops	12	14,060	11	12,868
Torpedo boats	72	382,260	110	667,704
Transports	28	1,460,200	24	1,386,366
Sailing vessels	46	65,150	42	46,082
Training ships	4	80,320	3	67,264
	389	£12,549,950	378	£12,541,200

German Navy Estimates.

Head of Service.	Voted 1888-89.	Voted 1887-88.	Voted 1886-87.
	£	£	£
Admiralty	20,720	30,160	28,715
Hydrographical Department	7,954	17,420	17,255
Stations	21,066	21,754	11,274
Legal Expenses	1,387	1,390	1,387
Religious Ministration	2,305	2,280	2,180
Officers and crews	385,435	366,950	343,880
Maintenance of Ships in commission	273,270	280,550	285,590
Victuals	146,044	150,480	147,630
Clothing	5,029	4,750	4,834
Dockyard and Garrison	43,770	41,190	39,860
Lodging Allowances	33,640	32,800	31,200
Medical Service	29,059	28,610	27,751
Travelling expenses, Freight, &c.	21,500	21,500	17,350
Education	6,453	6,300	6,247
Yards wages, Maintenance and Naval Construction	552,395	704,740	688,066
Ordnance	107,167	103,525	97,519
Torpedo service	49,416	34,525	27,232
Pilotage, Buoys, Beacons, &c.	10,016	9,985	9,375
Miscellaneous Expenses	8,414	8,475	7,703
Ordinary Estimate	1,735,040	1,856,900	1,795,050
Extraordinary Estimate.			
New construction	276,000	179,950	79,550
Torpedo service, including Torpedo Boats	130,625	33,300	173,250
Naval Ordnance	70,650	56,250	17,500
New Works and Repairs of Buildings	168,745	196,390	223,795
Total Estimate, Ordinary and Extraordinary	2,381,060	2,322,790	2,280,145

In 1884 a special vote of £547,000 was granted for the purchase of torpedo boats, the balance unexpended to be carried on from year to year.

PROVISION is made in the GERMAN ESTIMATES 1887–8 and 1888–9 for the CONSTRUCTION of the following VESSELS.

—	1887–8.	1888–9.
Ordinary Estimate.	£	£
Completion of cruiser corvette Irene to replace Elizabeth.	75,000	..
Completion of cruiser corvette Prinzessin Wilhelm to replace Ariadne	120,000	40,000
Completion of a transport to replace Eider	2,500	..
Completion of aviso to replace Pomerania	40,000	40,000
Extraordinary Estimate.		
Completion of cruiser Schwalbe	30,000	..
Completion of cruiser B.	30,000	30,000
Completion of aviso Wacht	50,000	..
Commencement of cruiser corvette H.	..	45,000
Commencement of cruiser C.	..	50,000
Commencement of aviso E.	..	25,000
Commencement of Torpedo Division Boats	..	50,000
Construction of small vessels, &c.	52,500	70,000
Total	£400,000	£350,000

PERSONNEL.

2	Vice-Admirals.
5	Rear-Admirals.
30	Captains.
54	Captains of corvettes.
108	Lieut.-Captains.
176	Lieutenants.
135	Sub-Lieutenants.
100	Naval Cadets.
47	Chief Engineer officers.
76	Medical officers.
45	Paymasters.
292	Warrant and Petty Officers.
150	Gunnery Officers.
1,293	Gunners.
6,463	Sailors.
500	Boys.
45	Musicians.
889	Officers for Artillery and Torpedo Depot.
1,054	Marine battalion.
3,283	Officers and Seamen employed in Naval Dockyards.
14,747	

MEMORANDUM ATTACHED TO THE ESTIMATES FOR THE IMPERIAL GERMAN NAVY, 1887–8.

These remarks are in continuation of those made on the German estimates for 1884.

It is quite obvious that a Navy cannot live from hand to mouth. It is desirable to provide for a fixed expenditure some years in advance. Whilst the organization of a modern army must ensure that in case of necessity every man should be available for the defence of the country, the organization of the Navy must be confined within narrower limits.

A decision must be arrived at as to the number of the *personnel* and the amount that can be provided by the country for the maintenance of the Navy, to meet a possible hostile combination.

After the outbreak of war, the strength of the Navy can be but slightly increased. The Mercantile Marine cannot, then, be counted on for fighting purposes. Our preparations must be made in time of peace. An increase in the number of ships entails a corresponding increase in the *personnel*. Before deciding on what is to be the strength of the German Navy in time of peace, we must first examine the strength of the other naval powers, and determine with which power our Navy must be on an equality. Whilst, in the consideration of the expenditure to be incurred for our Navy, our chief care must be for the wants of our own country, yet there are certain duties to be performed by a Navy that can only rightly be determined by a comparison with the strength of other navies. Even if we confine ourselves to the simplest form of naval warfare—that of coast defence—the strength of our navy must largely depend upon that of possible hostile combinations. And it must be borne in mind that, during the past thirteen years, circumstances have not tended to improve our position.

The Italian Navy can congratulate itself on a steady advance. The Russian Navy, too, leaving ours behind, has advanced with rapid strides.

Spain, America, Turkey, and Greece, have all considerably strengthened their fleets, and may effect still further improvements in the future. The programme of 1873 demanded that our naval strength should be that of a power of the second rank. Inferior as we are to Italy and Russia, we can now only be regarded as a naval power of the third rank. Are we any longer to content ourselves with this position? Or is not an increase in our naval strength essential to our future prosperity? These are the momentous questions which the German empire must face.

No naval power can henceforth successfully undertake the task of ruling the seas. It is only with reference to limited areas that any such question can arise.

A naval victory will, however, be the prelude to an extensive cruiser warfare, or to offensive operations on the enemy's shore. Against powers with extensive commerce, such a cruiser warfare will, even if slow in its working, be decisive in its results. The more closely we examine the question of the adaptability of merchant ships and sailors for naval operations, the more we are convinced that in our own, as in other navies, but limited success can follow any such experiment.

In the event of war, we should be limited to the cruisers which we maintain in time of peace for political purposes. The number of such ships, formerly classified as corvettes and gunboats of the first and second class, but now as cruiser frigates, cruiser corvettes, cruisers and gunboats, have hitherto amounted to thirty, viz., twenty corvettes, and ten gunboats; these are in addition to four ships for training purposes. In the note to the estimates 1886-7, it was explained that an increase in this number was absolutely requisite for foreign service. Even if we come to the conclusion that with thirty ships for foreign service we are sufficiently prepared for an outbreak of war, we must not shut our eyes to the fact that a great portion of these ships are not in a condition to admit of their employment as naval cruisers, on account of the obsolete nature of their construction.

Warships, constructed on the latest principles, attain a rate of speed as high as that of the majority of mercantile and passenger boats.

The demands of the Navy for the next few years, so far as cruisers are concerned, must be restricted to this, that this number of thirty, exclusive of training ships, be made up of serviceable cruisers, and the obsolete ships replaced by those of newer construction.

Coast defence may become of greater importance to us than cruiser warfare. With naval powers, other than those of the first rank, coast defence must be the primary object of their organization.

This object is all the more necessary for Germany, since the strength of the other navies has immeasurably increased, and since the object of a naval war is to destroy the commerce and devastate the shores of the foe. We must, at any rate, provide that naval powers of the second rank may not be able to attain this object. For this purpose of coast defence our naval organization need not be so effective as would be the case did we propose to undertake naval operations of an offensive nature. Coast defence must not, however, be interpreted in such a manner as to totally exclude offensive operations. It is often possible for the weaker defender to harass the stronger attacking party. To effect this, the defending party must make use of every means—the line-of-battle ship as well as the torpedo boat, the aviso equally with the armoured gunboat.

In the Memorandum of 1884, the question is raised, whether or no it would be preferable to construct armoured corvettes or gunboats instead of larger ships. Even to-day that question cannot be decisively answered. But this is certain, that even the further construction of heavily armoured ships with the heaviest artillery would not release us from the necessity of constructing smaller armoured ships with light draft for the defence of the mouths of our rivers.

If the financial position of the Empire will not permit of progress in both directions, there can be no doubt that the smaller type of vessel must have the preference. Without these we should not, in time of war, be in a position to defend the mouths of our important rivers. The construction of the new canal of the North-East Sea, gives the mouth of the Elbe a military importance it has not hitherto possessed.

The defence of the mouth of the Elbe cannot be undertaken satisfactorily from the land alone—there must be co-operation on the part of the Navy. Some sixteen miles north-west of Cuxhaven, the narrow channel of the Elbe forms a passage. This passage, from the west of the canal to the North Sea, must, at all hazards, be kept open for passing ships.

After providing for the replacement of obsolete cruisers and avisos, our present programme, apart from the large number of torpedo boats specially provided for in 1884, will only provide for the construction of ten armoured gunboats for the defence of the Elbe and various places on the coast. It must also be borne in mind that the replacement of the armoured ships Grösse Kurfürst, and Prinz Adalbert, have not yet been completed. The construction of six of the ten gunboats may be spread over a number of years, so that their completion may coincide with that of the North Sea Canal.

As regards the *personnel*, an annual increase during the next five years of 15 officers and 500 men would appear sufficient.

Having pointed out the aims, which the development of the Navy should assume for the next five years, it remains to be seen how the money for carrying out this purpose should be obtained.

The question was raised by the Budget Commission last year, whether the construction of new vessels could not be arranged by fixing an annual sum to be apportioned year by year. With this sum the Admiralty would have to be content. The Admiralty, after careful consideration, determined to adopt this proposition. As the construction of each ship is usually spread over a period of some years, and as the estimates for various years are closely connected, the Admiralty is compelled to embrace a longer period for their programme. On the other hand, such a programme can only be general in its nature; fresh knowledge, a new invention, or even an accident, may render an unexpected modification necessary. If, however, a programme more comprehensive in its details has once been placed before the public, and has been approved by Parliament, the change of such a programme is ever beset with difficulties.

The Government would prefer a certain sum being fixed for five years, on which they could reckon with certainty for shipbuilding purposes—repairs as well as new construction.

This would not dispense with the necessity of appropriating fixed sums to each ship, or for obtaining the consent of Parliament to such appropriation.

Whilst an exceptional financial position might make modifications necessary, the State would not be debarred from meeting extraordinary demands by exceptional means. This much at least would be gained, that we should know on what sum to reckon under normal circumstances.

The apportionment of this sum would be a matter for consideration.

The hard and fast line between replacement and new construction, which in many cases is illusory, would disappear.

It not unfrequently happens that ships whose replacement has been approved continue to sail side by side with the new ship. Ships frequently continue in existence after they have become useless in a military sense.

It is requisite now to consider what sum should be fixed for the next five years in order to keep up the existing floating material of the Navy, and to increase it, as recommended above, by the addition of the armoured gunboats.

The cost of the construction of the existing fleet—exclusive of torpedo boats and of artillery and torpedo armament—amounts to £8,973,520. To this must be added the sum of £547,000 voted on the 12th of April, 1884, for torpedo boats, and £200,000, the value of the old torpedo boats, as well as the various new inventions and improvements which have been built into ships since their first construction. This would raise the value of the German War Navy to about £10,000,000 sterling.

If we could with any certainty fix the duration of the life of the various classes of ships, it would be easy to estimate in what time it would be requisite to replace them.

Sixteen years has been calculated as the life of a wooden ship and thirty for an iron one.

This last figure, according to our experience, is much too high. The actual life of an iron ship might be placed even higher, if its decadence as a fighting machine did not commence at a much earlier date, in consequence of the rapid improvements made in more modern ships.

The extent to which the advance of science influences the use of ships for fighting purposes is shown most clearly in the case of avisos. A ship with inferior speed ceases to fulfil the duties of an aviso.

In addition to this, the use our vessels are put to, even in time of peace, unduly affects their position for fighting purposes. The rapid and short manœuvres, firing, and vibrations from other causes, all tend to subject a war vessel to greater strains than would be experienced by a merchant vessel.

The torpedo boat moreover, on account of its delicate construction, cannot be expected to have a long life.

If, in spite of all these considerations, we were to put the life of our ships at thirty years, then £10,000,000 divided by 30 would give the sum of £333,000 as the annual sum to be taken for replacement.

In order to calculate in another way the sum necessary for annual replacement of worn out or obsolete vessels, a comparison may be made with what the larger shipping establishments write off every year from the value of their new ships.

The Nord Deutscher and Stettiner Lloyds, write off 5 per cent. per annum. Slomans of Hamburg write off from 6 to 7 per cent. If we adopt the lowest of these figures, the annual amount requisite for replacement for the Imperial Navy would be £500,000.

In the seven years 1879–80 to 1886–87, the average annual sum expended in replacement has only amounted to £145,000. This can only be explained by the newness of many of the ships, and by the fact that the Government was fully occupied with carrying out the programme for the construction of new vessels.

For the next few years some of the ships will still be sufficiently new to admit of a small sum being set aside for replacement. But this state of affairs will not last long.

Apart from the fact that military necessities might require the substitution of new for obsolete vessels, it must be remembered that the building of ships of war is becoming more costly than ten or twelve years ago.

The cost of steam machinery grows with the cubes of the extra speed demanded.

The necessity for greater coal space increases the displacement and consequently the size of the ship. Torpedo armament, electric light, copper bottoms, all require a considerable extra expenditure.

For instance, in a ship like the Charlotte the difference between a zinc and copper bottom is £14,500.

The arrangements for electric light cost £3000 per ship.

It may, therefore, be stated with tolerable certainty, that for efficiently providing replacements for our ships of war, a sum not less than £500,000 will be annually required. If we should unfortunately be compelled to put up with a lesser sum, this could only be done at the expense of future years, and even then no smaller sum than £250,000 would be sufficient. If in addition the six armoured gunboats for the mouth of the Elbe are to be ready at the same time as the completion of the canal, then in the course of the next five years, four of these would fall due, necessitating an expenditure of £700,000 or £140,000 per annum.

If we add to this the minimum sum of £250,000 for replacement, we should in round numbers require £400,000 annually for the next five years for new construction, exclusive of torpedo and artillery armament.

Should a further extension of our torpedo flotilla—beyond that provided for in 1884—be found necessary, an extra demand for this purpose could not be avoided.

If, therefore, Parliament will consent to place at the disposal of the Imperial Navy a round sum of £400,000 per annum for five years, a great many military desiderata in respect of shipbuilding will not be completely fulfilled, but it will enable the Admiralty to carry out the work of new construction in a more profitable and businesslike manner.

Austrian Navy Estimates.

ORDINARY ESTIMATE.

Head of Service.	Voted 1887.	Voted 1886.	Voted 1885.
	£	£	£
Pay of Officers and Men	99,785	99,380	97,307
Allowances to Ditto (including Clothing)	86,715	86,715	86,715
Lodging and Service on Shore	47,641	43,753	42,241
Victuals, &c., Service Afloat	107,167	107,166	107,166
Hydrographical Department	1,658	1,658	1,658
Educational Establishments	6,764	6,714	6,764
Hospital Ditto	8,150	8,703	8,137
Stores and Wages for Maintenance and Repair of Fleet	168,360	168,360	259,787
New Construction (including Machinery)	105,050	104,050	
Naval Ordnance (including Ammunition)	16,170	16,170	16,170
Torpedoes and Mines	1,880	1,880	1,920
New Works and Hydraulic Machinery	16,015	16,015	15,920
Miscellaneous Expenses	10,140	10,140	22,475
Pensions, &c.	38,990	34,550	34,565
Total Ordinary Estimate	£714,485	£715,254	£700,621
EXTRAORDINARY ESTIMATE.			
Naval Construction	124,265	128,800	112,650
Naval Ordnance	25,145	16,689	30,954
Torpedoes	11,875	14,570	..
New Works and Machinery	9,835	10,310	10,470
Miscellaneous Expenses	760	481	649
Total Ordinary and Extraordinary	£886,365	£886,104	£855,344

RECAPITULATION.

	Ordinary.	Extraordinary.	Total.
	£	£	£
Proposed for service of the year 1887	716,000	171,850	887,850
Voted for 1886	706,565	171,810	878,375
Increase for 1887	£9,435	£40	£9,475

The Austrian florin has been calculated at 1*s.* 7*d.*

Austrian Navy Estimates—continued.

Provision is made in the Estimates for 1887 for Work on the following Vessels.

	Amount to be expended in 1887.
	£
Advancement of Armoured Vessel, Kronprinz Erzherzog Rudolph .	47,950
Advancement of Armoured Vessel, Kronprinz Erzherzogin Stephanie .	49,000
Completion of Torpedo Vessel, Ersatz Seehund	37,765
Construction of Torpedo Boats	59,060
New Cruiser Ram	18,050
Steamer for River Service	2,050
Repairs to Machinery of Lissa-Tegethoffe and Prinz Eugen . . .	8,410
	£222,285

PERSONNEL.

Provision is made in 1887 for the pay of the following Officers and Men:—

2	Vice-Admirals.
7	Rear-Admirals.
18	Captains.
48	Commanders.
192	Lieutenants.
159	Sub-Lieutenants.
163	Midshipmen and Cadets.
9	Chaplains.
66	Surgeons.
234	Engineers.
157	Commissariat.
45	Instructors, &c.
134	Other ranks.
7,340	Seamen, &c.
Total Number 8,574	

Italian Navy Estimates, 1887-88.

1 JULY, 1887, TO 30 JUNE, 1888.

No	Head of Service.	Proposed. 1887-88.	Voted 1886-87.	Voted, 1885-86.
		£	£	£
	Admiralty Office	34,150	32,630	29,996
	Mercantile Marine	245,130	215,740	54,422
	Ships in Commission, Reserve, &c., Allowances to Officers and Men	170,260	200,645	148,000
	Commissioned Officers' Pay	89,880	91,570	91,103
	Engineer Officers, Constructive Staff	30,020	27,130	26,042
	Commissariat Officers	34,450	31,589	31,925
	Medical Officers	19,760	17,360	17,367
	Crews of Vessels	238,060	207,700	190,000
	Artificers	29,600	28,944	28,385
	Accountant Staff	10,760	10,652	10,615
	Police	..	..	10,615
	Riflemen	10,780	9,890	9,860
	Victuals	194,210	176,046	163,289
	Watchmen and Lighting	5,270	5,120	4,179
	Naval Hospitals, Medical Stores, &c.	12,080	11,440	9,640
	Medals and Special Pensions	1,080	1,080	1,200
	Coal and other Fuel	155,840	100,800	88,400
	Official Staff of Dockyards	7,690	6,650	5,600
	Naval Institute	26,190	19,600	17,347
	Scientific Branch	10,470	7,600	6,970
	Legal Expenses	1,200	1,200	1,200
	Freight, Transport, &c.	38,000	28,000	19,040
	Maintenance of Fleet, Stores	348,000	248,000	220,000
	„ „ Labour	246,660	178,000	140,000
	Naval Ordnance including Torpedoes	301-500	196,000	140,000
	New Works and Repairs	84,600	60,000	48,000
	Construction of New Vessels—Ordinary Vote	880,000	940,000	800,000
	Naval Expenditure for Colony of Massowah	186,300	Included in	other Votes.
	Rent of Crown Property used by Government	90,820	90,674	89,405
	Extraordinary Estimate.			
	Construction of New Vessels	240,000	540,000	500,000
	„ „ Naval Arsenal at Taranto	26,000	44,000	68,000
	„ „ Dry Dock at Spezia	42,000	52,000	48,000
	Hydraulic Crane at Venice	..	..	6,000
	Submarine Coast Defence	180,000	100,000	60,000
	Half Pay and Reserved Pay	4,640	4,640	4,400
	Mercantile Marine Sick Quarters in Island of Asinasa	..	4,000	..
	Imprest Account for Advances to Officers	100,000	80,000	60,000
	Total Estimates, Ordinary and Extraordinary £	4,095,400	3,768,700	3,139,000

Italian Navy Estimates—continued.

COMPARISON BETWEEN SHIPBUILDING AND ORDNANCE VOTES, 1886–87 AND 1885–86.

Italian Estimates.	Proposed 1887–88.	Voted 1886–87.	Voted 1885–86.
	£	£	£
New Construction	1,120,000	1,480,000	1,300,000
Maintenance of existing Fleet . . .	594,600	426,000	360,000
Artillery and Torpedoes	301,500	196,000	140,000
Submarine Coast Defence	180–000	100,000	60,000
	2,196,100	2,202,000	1,860,000

NUMBER OF OFFICERS AND MEN PROVIDED FOR IN ITALIAN NAVY ESTIMATES.

	1887–88.	1886–87.	1885–86.
Admirals	1	1	1
Vice-Admirals	5	5	5
Rear-Admirals	12	11	11
Post Captains	36	34	34
Captains of Frigates	43	40	40
Captains of Corvettes	58	50	40
Lieutenants	240	230	220
Sub-Lieutenants	142	142	142
Midshipmen	75	71	64
Engineers, Constructors	73	73	73
Naval Engineers	100	98	94
Medical Officers	153	135	125
Commissariat Staff	344	315	314
Engine-room Staff	2,610	2,020	1,708
Torpedo Staff	950	752	612
Gunnery Ratings	1,655	1,553	1,553
A. B.'s and Ordinary Seamen	4,690	4,135	4,643
Armourers and other Artificers	500	483	338
All other ranks	1,995	2,057	1,946
	13,682	12,205	11,963

Italian Navy Estimates—continued.

NEW CONSTRUCTION.

The whole of the £2,000,000 voted as an Extraordinary Estimate in July, 1877, and July, 1884, having been expended, a further Extraordinary Estimate of £500,000 was granted in December, 1886. £260,000 of this sum was appropriated for the service of 1886–87, leaving a balance of £240,000 for the year 1887–88.

This, added to the grant of £880,000 in the ordinary estimates, makes a sum of £1,120,000 available for new construction. With this sum it is proposed to carry out the following programme for 1887–88:—

Name of Vessel.	Class.	Tons Displacement.	Speed.	Advancement.	Where Building.
ARMOURED VESSELS:			Knots.		
Ruggiero de Lauria .	Armoured Vessel	11,000	16	To complete	Naples.
Francisco Morosini . .	,, ,,	11,000	16	,,	Venice.
Andrea Doria. . .	,, ,,	11,000	16	,,	Spezia.
Re Umberto . . .	,, ,,	13,351	18	To advance.	Castellamare.
Sicilia	,, ,,	13,351	18	,,	Venice.
Sardegna . . .	,, ,,	13,298	18	,,	Spezia.
UNARMOURED VESSELS:					
Etna	Deck - protected Cruiser .	3,530	17	To complete.	Naples.
Vesuvio . . .	,, ,,	3,530	17	,,	Leghorn (Orlando Brothers).
Stromboli . . .	,, ,,	3,530	17	,,	Venice.
Ettore Fieramosca . .	,, ,,	1,856	17	To advance.	Leghorn (Orlando Brothers).
Volturno . . .	,, ,,				
Morvyambano . .	Torpedo Cruiser	741	20	,,	
Montebello . . .	,, ,,	741	20	,,	
Confienza . . .	,, ,,	741	20	To complete.	
Curtatone . . .	Gunboat . .	..	..	To advance.	
Galileo	Aviso . .	..	..	,,	
Archimede . . .	,, . .	..	..	,,	

NEW VESSELS TO BE LAID DOWN IN 1887–88.

2 Protected vessels. 2nd class.
4 Torpedo cruisers.
2 Gunboats.
12 Seagoing and coast defence torpedo boats.

The Minister of Marine reported to the Commissioner appointed to examine the Navy estimates that his administration did not intend

Italian Navy Estimates—continued.

to lay down any new armoured vessels, and that it was proposed to concentrate all resources on swift cruisers and torpedo boats.

A further Extraordinary Navy Estimate for £3,400,000, to be spread over the next ten years was brought forward in March, 1887.

AMOUNTS voted in ITALIAN NAVY ESTIMATES, from 1873 to 1886.

Year.	Ordinary Estimate.	Extraordinary Estimate.	Total.
	£	£	£
1873	1,211,780	42,800	1,254,580
1874	1,264,888	39,800	1,304,688
1875	1,266,992	207,240	1,474,232
1876	1,415,084	51,996	1,467,080
1877	1,604,676	41,760	1,646,436
1878	1,562,476	109,000	1,671,476
1879	1,525,220	105,160	1,630,380
1880	1,606,936	128,000	1,734,936
1881	1,594,772	116,344	1,711,116
1882	1,762,162	112,320	1,874,482
1883	2,212,620	220,000	2,432,620
1884 1 Jan. to 30 June	989,644	118,520	1,108,164
1884–85	1,830,072	252,400	2,082,472
1885–86	2,392,600	746,400	3,139,000
1886–87	2,944,060	824,640	3,768,700
1887–88	3,502,800	592,600	4,095,400

RUSSIA.

We are indebted to the *Times* correspondent at St. Petersburg for the following interesting account of Russian activity in naval construction during the past year:—

Ships building for the Russian Navy.

The naval and general shipbuilding activity in both the north and south of Russia has been unusually great for this country. On the Neva below bridges, the Baltic works, under the superintendence of Captain Kasy, have turned out the Iyon, and begun the construction of another first-class, half-armoured frigate, Remembrance of Azoff, 377 feet 9 inches long, 50 feet beam, and 6000 tons displacement. This will be the longest warship in the Russian Navy. The same company has also produced within the last two years three new cruisers, the Vladimir-Monomach, Admiral Nakhimoff, and Dmitri Donskoi, besides several torpedo boats.

At the Russo-French Company's yard on the Galerney Island opposite two large ironclads are in course of construction, Alexander II. and Nicholas I. The latter had her keel laid down in July 1886, in the presence of the Emperor and Empress. Her dimensions are—length, 326 feet; beam 67 feet; with a displacement of 8441 tons. A couple of light armoured corvettes were also built by the same firm in 1884.

The Cronstadt Docks do nothing in the way of building, but only repair ships, and the once flourishing port of Archangel shows no signs of joining in the revival of Russian shipbuilding. The English firm of Crighton, at Abo, on the Finnish coast, delivered to the Government in the summer of 1886 two gunboats and fifteen small steam launches. Above the Neva bridges the only yards remaining idle appear to be at the Okhta works, where nothing has been done since 1878, at the time of the Turkish War, when twenty torpedo boats were built there by Mr. Bain. This English builder floated eleven steamboats and smaller craft, mostly for Government service, during the summer of 1886, from his own works on the opposite bank; and the English firm of Boots & Papmall, on the Little Neva, are engaged in executing an order for two paddle steamers. These boats, which are no doubt intended for military transport on the

Oxus, will be taken to pieces and conveyed overland to their destination by the trans-Caspian railway. At the Russian Company's works, further up the river, the Government have ordered two more steamers for Vladivostock.

On the Black Sea are the two big ironclads, Tchesme and Catherine II., launched in June 1886, and the Sinope, still on the stocks, while a fourth is to be laid down at Sevastopol. In the Sevastopol and Nicolaieff yards there are six new Cossack gunboats, one torpedo catcher, and about a dozen torpedo boats, and several more of the latter are being made by a German firm at Odessa. The Admiralty has furthermore ordered two gunboats abroad at a cost of £113,895 apiece, five torpedo boats at the new Admiralty yard at Ijora, the Baltic works, and Nicolaieff, without counting eight others ordered in England, Germany, and France. Those built in the Russian Navy yards are to cost £8,333 each. Two other vessels have been built abroad for Vladivostock, one of which, a schooner, is called Aluta; this boat measures 151 feet by 31, with a displacement of 811 tons, and is armed with rifle cannon and rapid-firing guns. According to recently published information, Russia already heads the list of European Powers in the matter of torpedo boats. The number in 1886 was stated to be 175, whereas England had only 158, and France 153.

The Russian cruiser, Amiral Kornilow, which is building for the Russian Government by the Société des Ateliers et Chantiers de la Loire, under the personal superintendence of M. Thevenet, was launched on April 9th, 1887, at Saint Nazaire. This beautiful cruiser is 107 metres in length, 8260 indicated HP., and will have a speed of 19 knots. She will be armed with 14 guns of 15 centimetres, 10 revolving, and 6 quick-firing guns.

The third of the gunboats constructed by the Company of Navigation of the Black Sea for the Black Sea Fleet, has lately been launched. She is of the same type as the Terets, launched in September last. All the gunboats of this type are 64 metres in length, 10·7 in breadth, and with a displacement of 1224 tons. Their armament consists of 2 guns of 20 centimetres.

General programme of construction.

The following plan, translated from a copy of the Russian document, was proposed in 1881, approved by the Emperor in 1882, and first put into execution a little later. Modifications are of course being made to accord with the constant change of ideas and the rapid improvements in naval construction, as the realization of the project is proceeded with; but its principal outlines are still the guide of the work now going on. A noticeable alteration appears to have been made in respect to the six Cossack gunboats building on the Black Sea, unless these boats are intended eventually to make up the eleven set down in the following programme, as for the Fleet in the Baltic:—

For the Baltic.

	Approximate Tonnage.
11 First-class ironclads	10,000
4 Second-class „	7,000
11 Gunboats.	
10 Cruisers (about the dimensions of the Iris).	
5 Transport ships	2,000

For the Black Sea.

6 First-class ironclads	10,000
6 Despatch boats.	
6 Torpedo boats.	

For the Caspian.

2 Sea-going paddle Steamers	1,000
2 Tow boats.	
6 Steam-launches.	

For the Pacific.

4 Gunboats.
4 Torpedo boats.

For the White Sea.

1 Small schooner.
4 Steam-launches.

The types and dimensions of those vessels of which the tonnage is not given, will have to be decided upon in the course of carrying out the project.

The Minister of Marine considers that he shall require—

	£
For shipbuilding	15,468,625
„ artillery	1,904,750
„ torpedoes	559,083
Total	£17,932,458

To make up this sum £8,500,000 can be taken from the annual naval estimates, and £9,500,000 will have to be provided by the Minister of Finance on extraordinary credit. With this means it is considered that the above vessels can be constructed in the course of twenty years. It has been suggested by the Minister of Marine, as a basis for a proposal to be made to the Government, that the Admiralty and private yards should undertake to construct these vessels for a term of from five to seven years at fixed dates and prices, the vessels and engines to be paid for at the rate of £425,000 annually, with 6 per cent. bonds for all work done over this amount of £425,000, according to official receipts. These 6 per cent. bonds would be paid out of the estimates for the following years. It is thus proposed to form a Financial and Shipbuilding Syndicate. If this proposal be accepted in principle, then it would rest with the Syndicate to propose to the Government the drawings, the specifications, and prices of the vessels.

The prices, calculated by the Minister of Marine for the different types of vessels, are as follows:—

	£
First-class ironclads	503,791
Second-class „	408,000
Cruisers	195,916
Gunboats	25,000
Torpedo boats	8,750
Transports (2000 tons net)	100,000
Caspian steamers	41,666
Tug boats	5,000
Steamboats or launches	2,083
Small schooners for cruising in the White Sea	10,000

All these prices are independent of artillery and torpedoes. In order to obtain the best results, and with a view to economy, the engines should be ordered of the best firms in England, France, and even Germany. The Russian factories will have enough to do in producing machinery after the samples already received from abroad.

Six large ships could be built at the same time at St. Petersburg—viz., two at the new Admiralty, one at the Galerney Island, one at the Nevsky Yard, and two at the Baltic Works. Small vessels can also be built on the small slips of the above yards, and at Crighton's, in Finland.

The first samples of torpedo boats should be ordered in England, France, and Germany, so as to avoid any risk. The Minister thinks that transports also should be ordered in England, as such vessels can be obtained there cheaper and more expeditiously.

For the contracts to be executed in the Black Sea, the matter becomes more difficult, in consequence of the absence of iron factories, shipbuilding yards, and machine shops. Experience has proved the futility of reckoning upon the factories in the Donetry basin, near the Sea of Azoff, and the despatch of materials from the Baltic leads to an extra expense of 50 per cent., so that most of the materials and engines for the Black Sea ships will have to be obtained from abroad.

All the above-mentioned dockyards are capable of being used for the building of large ships. Only three can be employed for first-class ironclads. Admitting four years to be sufficient for the completion of a first-class ironclad, and that at St. Petersburg three of them could be constructed at the same time, while a fourth could be fitted out and receive its engines, about twenty years would be required for the production of all the proposed vessels for the Baltic On the Black Sea two large vessels might be built at Nicolaieff at the same time.

The following further information relating to the Russian fleet in the Black Sea is taken from the *Morning Post* of the 26th December 1887:—

We learn from Sebastopol that great activity prevails in preparing the Russian Black Sea fleet for eventualities, workmen being engaged in completing the new vessels, not only night and day, but on Sundays as well. Last week the launch took place of the Uraletz, a so-called "gunboat," which makes the sixth vessel of a fleet of powerful corvettes Russia has now at her disposition in the Black Sea. This fleet will take such a prominent part in any naval war that may occur in the Black Sea that a description may not be inopportune. The average length of British gunboats is about 150 feet; but these Russian vessels are 210 feet long, and broad in proportion, their dimensions approaching the size of our corvettes of the Comus class, which are only 10 feet or 15 feet longer, and even exceeding in size some of the corvettes recently added to the British fleet. Their armament also is formidable, being superior to that of most of our seagoing gunboats and corvettes. It consists of two 8-in. guns, weighing 9 tons apiece, one 6-in. gun, six machine guns, and two tubes for discharging torpedoes. Most of the British corvettes have 6-in. and 7-in. guns only, and the seagoing gunboats' weapons of still inferior calibre. Turkey has no similar vessels at all, and could only fight them with her ironclads. The names of the six Russian gunboats are—Tchernomoretz, Zaporojetz, Donetz (built at Nicolaieff), and Uraletz, Teretz, and Kubanetz, at Sebastopol. All six are of the same size, type, and strength. The engines of all of them, of 1500 indicated horse-power, have been manufactured by Messrs. Napier and Co., of Glasgow. Four are quite ready for active service; the final two, launched within the last few days, are to have their completion hastened by every possible means.

In the meanwhile Russia's own ironclad fleet in the Black Sea is beginning to make a display. In all, six of the most formidable type are to be constructed, and of these two are almost ready for active service, and another is rapidly approaching completion. The three are of the same type and size, being 320 feet long, 69 feet broad, and having a draught of 25 feet. Their displacement is 10,150 tons, and their armour plating 16 inches thick. The armament comprises six 12-in. guns, weighing 52 tons apiece, seven 6-in. guns, weighing 4 tons apiece, and a number of machine guns and tubes for discharging torpedoes. The engines are of 11,500 horse-power, steaming at 15 knots. The Tchesme is to go on a trial cruise along the Black Sea coast in a few days' time, and the Catherine II. will follow shortly afterwards. The Sinope will not be finished before next spring. In the meantime the Tchesme and the Catherine II. must be able to confront any of the ironclads of Turkey, none of whom in any way approach them in thickness of armour and strength of armament. Even England has only a few ironclads, such as the Anson, Benbow, and Camperdown, superior to them in strength.

At the same time, Russia has not been indifferent to the torpedo branch of the Black Sea fleet, having 20 first- and second-class torpedo boats at Sebastopol, a torpedo cruiser (the Captain Sacken), 213 feet long, and steaming at 20 knots; besides 50 smaller torpedo cutters that were sent by rail to the South during the war scare two years ago. In general the Russian torpedo flotilla is very much more powerful than anything the Turks possess, and would prove troublesome even to an English fleet. Torpedo factories exist at Nicoliaeff, Sebastopol, and Kertch. In regard to transport also Russia has greatly improved her position of late years, having at her command not only the six steamers of the Volunteer Fleet but also the half a dozen new steamers which the Black Sea Steam Navigation Company has added to its fleet since 1878, and as many more belonging to private Russian firms.

Spanish Navy Estimates.

At the commencement of the year 1887, the Cortes agreed to a vote of £9,000,000 to be expended in the course of the next nine years in carrying out the following programme for the reconstruction of the Spanish Navy, viz.:—

1st. For completion of ships already under construction.

2nd. For the laying down new vessels.

The following is the programme of new ships to be laid down:—

Programme of reconstruction.

——	Tons.	Speed.		Cost each Vessel.	Total Cost for Class.
		Natural Draft.	Forced Draft.		
				£	£
Three cruisers	4,500	19	21	280,000	840,000
Eight cruisers	3,200	19	21	200,000	1,600,000
Six Torpedo Cruisers	1,500	21	23	100,000	600,000
Four Torpedo Cruisers	1,100	18	21	80,000	320,000
Ninety-six Torpedo-boats	100 to 120	..	..	24,000	2,304,000
Forty-two Torpedo-boats	70	..	..	16,000	672,000
One Transport to be fitted as a floating factory	..	..	..	100,000	100,000
	FOR SPECIAL SERVICE.				
Six Steel Torpedo Gunboats	500	16	18	60,000	360,000
Six " " "	350	16	18	40,000	240,000
Sixteen " " "	250	14	16	30,000	480,000
Twenty Steel Sloops	35	12	14	4,000	80,000
Total Cost of new Vessels to be constructed				£	7,596,000

COST OF COMPLETION OF VESSELS NOW UNDER CONSTRUCTION.

——	Tonnage.	Speed.	Guns.		Further expenditure.
			Number.	Calibre.	£
Pelayo, Steel Armourclad	9,900	16	12 1	12 Cm. 16 "	280,000
Reina Regente, Cruiser	5,000	..	6	12 "	220,000
Isla de Cuba, Torpedo Cruiser	1,030	15 to 16	6	12 "	52,000
Isla de Luzon " "	1,130	15 " 16	6	12 "	
Destructor " "	..	..	..	..	32,000
Torpedo Boats, 1st class	..	..	..	..	40,000
Alphonse XII. Cruiser	3,040	17	6	16 "	40,320
Reina Cristina "	3,040	17	6	16 "	40,320
Reina Mercedes "	3,040	17	6	16 "	47,000
Conde de Venadito "	1,152	..	..	..	23,140
Infanta Isabel "	1,152	..	5	12 "	27,980
Don Juan de Austria "	1,152	..	5	12 "	21,300
Isabel II. "	1,055	..	5	12 "	26,200
Cristobel Colon "	1,152	..	3	15 "	24,840
Don Antonio de Ulloa "	1,152	..	3	16 "	24,840
Extras	..	..	..	..	4,060
Total Cost for completion of Vessels building January 1, 1887					£904,000

	£
For Completion of Ships under construction 1st January, 1887 .	904,000
For Construction of Ships not commenced 1st January, 1887 .	7,596,000
For Development of Naval Arsenals..	400,000
For Submarine Defence	100,000
	£9,000,000

It is estimated that £1,400,000 of the above sum will be devoted to construction of torpedo boats for defence of the Colonies.

Ships of the Spanish Navy built and building.

The following is the armourclad and cruiser fleet at present afloat or under construction:—

Armourclads.—Spain possesses five armourclads, two of which have wooden hulls, and are almost useless. Of the three others, one alone, the Pelayo is modern, and has lately been launched at La Seyne, by the Société des Forges et Chantiers. The two others are the Numancia, of 7305 tons, which was launched in 1863, armed with Armstrong muzzle-loaders, 8- to 10-, and 7- to 8-inch; and the Vittoria, 7250 tons, launched in 1865, and armed with eight 9-inch Armstrong guns, and three Palliser guns of 18 centimetres. The speed of the Numancia is only eight knots; but the Vittoria having possessed a speed of eleven knots, the advisability of giving her a total refit is now being considered. It will thus be seen that Spain can only count on one effective armourclad, the Pelayo, and the new programme referred to above does not include provision for any armoured construction.

Cruisers—1st Class.—Spain includes among its first-class cruisers those of 3000 tons and upwards. Of these she possesses three completed and commissioned within the last five years, the Arragon, the Castilla, and the Navarre, all of 14 knots; she has besides, in various stages of completion, the four cruisers Alphonso XII., Reina Christina, Reina Mercedes, of 17 knots, and the Reina Regente, of 19 to 20 knots, the three first are of wood and unprotected.

The three cruisers Alphonse II., Reina Christina, and Reina Mercedes, have been constructed on the same plans in Spanish dockyards. Their hulls are of iron, and their principal dimensions are as follows:—Length between perpendiculars, 84·8 metres; maximum breadth, 13·2 metres; mean draft of water, 5 metres; displacement, 3040 tons; estimated speed, with 4800 horse-power, 17 knots. Their principal armament consists of six guns of 16 centimetres. The cruiser La Reina Regente is being built by the firm of Messrs. Thomson, on the Clyde. She will be about 100 metres in length; 15·2 in breadth; nearly 5000 tons displacement; 12,000 horse-power, with an estimated speed of from 19 to 20 knots. The bunkers will hold 1100 tons of coal, and she will be able to traverse a distance of 11,000 miles at 10 knots. The hull is built entirely of steel. The armament will consist of four guns of 24 centimetres, and six of 12 centimetres.

Second-class cruisers—from 900 to 1100 tons. Omitting those built before 1876, which are now practically useless, and those under construction, there only remain—the Velasco, of 1200 tons, launched in 1881, and Jorge Juan and Sanchez Barcavytegni, of 935 tons, launched in 1876.

TORPEDO FLOTILLA.

	Length. Metres.	
Castor	23	Constructed 1879.
Pollux	26	„ „
14 Torpedo boats, 1st Class	32 to 45	In various stages of construction.
Ariete	45	Under construction by Messrs. Thornycroft.

PERSONNEL.

Number of officers and men provided for in Spanish Navy Estimates:—

1	Admiral.
5	Vice-admirals.
21	Rear-admirals.
60	Captains of vessels.
88	Captains of frigates.
325	Lieutenants.
171	Ensigns.
21	Engineers-in-chief.
400	Artificers.
180	Warrant and petty officers.
14,000	Seamen.
Total 15,272	

SWEDEN.

The SWEDISH NAVY ESTIMATES for the YEAR 1887 amount to £1,497,600, showing an INCREASE of £27,376 over the ESTIMATES for the PRECEDING YEAR.

The chief points of interest for which provision is made are as follows:—

	Voted 1887.
	£
Naval ordnance	46,600
Fortifications of Karlsberg	10,660
Construction of an armoured vessel	37,300
„ a torpedo boat	7,200
Miscellaneous services	11,520
	£113,280

PERSONNEL

1	Vice-admiral.
3	Rear-admirals.
5	Colonels.
20	Captains and
43	Commanders.
43	Lieutenants.
26	Sub-lieutenants.
17	Chief engineer officers.
24	Medical officers.
254	Petty officers.
600	Mates.
220	Artificers.
4,670	Seamen.
Total 5,926	

United States Navy Estimates, 1887-88.

(1st July, 1887, to 30th June, 1888.)

Head of Service.	Voted 1887-88.	Voted 1886-87.	Voted 1885-86.
	£	£	£
Central Office	74,206	64,146	64,056
Pay of the Navy (Officers and Men)	1,471,116	1,428,070	1,406,156
Maintenance of Yards and Docks	82,292	51,200	40,800
Naval Asylum at Philadelphia	17,890	12,852	12,200
Bureau of Navigation, Pilotage, Surveys, Charts, &c.	36,188	23,358	21,522
Equipment of Vessels, Coal, Hemp, and other Stores	166,606	160,320	160,420
Recruiting Expenses	10,200	9,180	6,120
Construction and Repair of Vessels	354,438	192,372	373,768
Steam Machinery, Boilers, &c.	169,086	160,000	193,800
Victuals and Clothing for Seamen, &c.	268,628	231,048	221,340
New Works, Navy Yards and Naval Observatory	901,466	102,122	67,524
Naval Ordnance	237,230	30,906	32,844
Torpedo Service	16,014	11,934	12,240
Hospital and Medical Expenses	28,560	24,480	20,400
Naval Academy	41,566	37,494	36,970
Marine Corps	187,660	173,216	177,341
Miscellaneous Payments	2,754	54,478	76,500
Appropriations to cover Deficiencies	..	165,484	..
Total Ordinary Estimate	£4,066,940	£2,932,660	£2,924,001
Extraordinary Estimate for Increasing Strength of Navy	£1,122,000	£714,000	—
Total Estimates—Ordinary and Extraordinary	£5,188,940	£3,646,660	£2,924,001

The Dollar has been calculated at 4*s.* 1*d.*

United States Navy Estimates—continued.

PERSONNEL.

The sum provided for the pay of Officers and Men is calculated as follows:—

	£
Pay of Officers on the Active List	703,646
" " " Retired List	176,530
" Petty Officers and Seamen	510,000
Extra pay of Petty Officers and Seamen re-enlisting. 900 at £20	18,360
Pay of Clerks	23,336
	£1,431,872

Provision is made for the following Officers and Seamen on the Active List:—

1	Admiral.
1	Vice-Admiral.
7	Rear-Admirals.
9	Commodores.
45	Captains.
85	Commanders.
74	Lieut.-Commanders.
326	Lieutenants.
182	Ensigns.
58	Naval Cadets.
164	Medical Officers.
113	Paymasters and Assistant Paymasters.
70	Chief Engineers.
136	Assistant Engineers.
26	Cadet Engineers.
24	Chaplains.
12	Professors of Mathematics.
10	Naval Constructors.
19	Assistant Naval Constructors and Civil Engineers.
35	Boatswains.
36	Gunners.
51	Carpenters.
28	Sailmakers.
37	Mates.
214	Cadets at Naval Academy.
5,275	Seamen.
750	Boys.
7,787	Officers and Men on the Active List, and 2,225 Officers on the Retired List.

United States Navy—continued.

New Construction.

Provision is made for the construction of the following Vessels :—

Name.	Class.	Displacement.	Indicated Horse Power.	Armament.	To be met out of
		Tons.			
Newark .	1st Class Protected Cruiser . . .	4,083	8,500	12 6-inch B.L.R. Guns	Extraordinary Estimate.
Charleston .	” ”	3,730	7,000	” ”	”
Baltimore .	” ”	4,413	9,000	” ”	”
N. . .	” ”	4,324	*	” ”	”
” . .	” ”	4,053	*	” ”	”
” . .	Armoured Vessel	6,300	†	2 46-ton Guns 6 15-c. m. ”	”
” . .	” Cruiser	6,000	‡	” ” ”	”
	Gunboat Cruiser	1,700	3,000	6 6-inch B.L.R.	Ordinary Estimate.
	” ”	890	1,110	4 ”	”
	” ”	1,700	3,000	6 ”	”
	” ”	1,700	3,000	6 ”	”
	Dynamite Cruiser	725	‡	3 10½-inch Dynamite Guns	Extraordinary Estimate.
	1st Class Herreschoff Torpedo Boat	Feet. 138	§	4 Automobile Torpedoes	”

The completion of the four double-turreted monitors, Puritan, Amphitrite, Monadoch, and Terror.

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* Guaranteed speed 19 knots.
† Speed, 17 knots.
‡ Guaranteed speed 20 knots.
§ Estimated speed 23 knots.

The Extraordinary Vote for increase of the Navy is appropriated as follows :—

	£
For construction of Vessels and Monitors as above . .	816,000
For armament ” ” ” . . .	306,000
	£1,122,000

The total amount voted in 1886 as an Extraordinary Estimate to be spread over three years amounted to £2,259,300.

	£	
Of this sum there was appropriated for the service of 1886–7	714,000	
Ditto for the service of 1887–8 . .	1,122,000	
		1,836,000
Balance available for 1888–9 . . .		£423,300

Report of the Secretary of the Navy.*

It is with much satisfaction that the Department is able to report upon the occurrences of the past year. Many difficulties have stood in the way of the creation of a creditable new Navy. During the last year many of these have been removed, and if it is the will of the country that we should be possessed of a Navy able to maintain, when required, the honour and dignity of the Government, it can now readily be created. When the last annual report of the Department was made this country lacked three manufactories necessary to the construction and armament of a modern war vessel, viz., that of steel forgings for the heavier guns, that of armour for ironclad vessels, and that of the secondary batteries (machine and rapid-fire guns), an essential portion of the armament. Now all three manufactories are in process of construction under contracts with the Department.

The successful completion of the contract with the Bethlehem Iron Co. for armour and gun steel is here recorded, and the Secretary continues:—

The policy which has thus been so successfully pursued in the matter of armour and gun steel was also followed in the matter of secondary batteries, and with a like result. The Department declined to make any purchases of the Hotchkiss arms, previously adopted for our secondary batteries, except upon condition that a manufactory was established in this country, and, by the accumulation of orders, the inducement became in time sufficient to secure the desired result. The ease with which these difficulties were finally solved was most surprising, and furnished another and most notable illustration of the enterprise and courage of our business class.

It is also gratifying to report that the representatives of the Hotchkiss Company have ascertained that with the superior tools in use in this country in the manufacture of arms, the secondary batteries of ships can be made here and sold at prices less than we have paid for their foreign-made arms, and as low as they are produced there for any foreign Government. And such are the prices made to us by the company. In like manner the contracts for armour and gun steel are made at prices within 25 per cent. of the European price for the similar article, not greater than the difference in labour between the two countries, notwithstanding the heavy outlay for plant (estimated at £510,000) necessary to be made to undertake the contract.

* Extract from *Army and Navy Journal*, 10 Dec., 1887.

These gratifying results have been greatly stimulated by the shipbuilding interest of the country. My attention was early called to the fact that our shipbuilders were shut out from building for any foreign Government by reason of the fact that neither armour nor gun steel nor secondary batteries could be supplied in this country. The construction of war vessels for other countries has been a large industry for the shipbuilders of Great Britain. It is believed that our private shipyards can produce war ships equal and perhaps superior to those produced elsewhere when these industries shall have been established. The shipbuilders have, therefore, zealously co-operated with the Department in stimulating and furthering this object.

It is notable in this connection that the efforts of the Department to raise the standard of the material for the ships has resulted in a class of material believed to be superior to that ever produced for any similar purpose.

Some slight delay in construction of the cruisers under contract has doubtless resulted, and much jarring and unpleasantness at first; but, at the present time, all concur that the quality of the steel has been improved and that more reliable processes have come to light, and all dissatisfaction has disappeared. Especially has the steel made upon the Pacific coast been notable for its quality, and the construction of the cruisers there may mark an important event in its industrial history.

All of the unarmoured vessels heretofore authorized by Congress are in course of construction. The following Table embraces the necessary information concerning them. It includes those already completed.

The most notable fact connected with the work of the last year concerns cruisers Nos. 4 and 5 in the foregoing Table. Congress, by the legislation of last winter, put to the test the ability of the Department and of American shipbuilders to construct cruisers having the highest standards. And these cruisers are now under contract with adequate security for the attainment of the results guaranteed. American shipbuilders have in these contracts placed themselves in line with the foremost in the world.

These results were extremely gratifying to the Department. Both bidders for these ships bid to reach the speed upon the plans submitted by the Department. The plans purchased abroad constituted the basis of the plans submitted to competition, but by the modifications made and being made they are now beyond identification. Thus the result will be as was originally contemplated, viz., adopting at the outset the best known methods, native invention will enable us to improve upon them and to keep pace with the most forward.

PROTECTED AND UNARMOURED

Name and Type.	Keel laid.	Where Built.	Condition.	Dimensions.			Dis-placement.	Collective Power or Speed in each case.
				Length between Perpendiculars.	Beam.	Mean Draught.		
				Feet.	Feet.	Feet.	Tons.	
Dolphin . . . (Despatch vessel)	1882	Roach's	Commissioned	240	32	14¼	1485	*2240
Boston . . . . (Protected cruiser)	1882	Ditto	Ditto	270	42	17	3189	*3780
Atlanta . . . (Protected cruiser)	1882	Ditto	Ditto	270	42	17	3189	*3356
Chicago . . . (Protected cruiser)	1883	Ditto	Awaiting trial	315	48 1–6	19	4500	†5000
Charleston . . (Protected cruiser)	1887	Union Iron Works	Building	300	46	19½	3730	‡7000
Baltimore . . . (Protected cruiser)	1887	Cramp's	Ditto	315	48½	21	4413	‡9000
Gunboat No. 1 . (Cruiser)	1887	Ditto	Ditto	230	36	14	1700	‡3000
Gunboat No. 2 . (Cruiser)	1887	Columbian Iron Works, Baltimore	Ditto	175	31	11 7–12	890	‡1100
Newark . . . (Protected cruiser)	1887	Cramp's	Ditto	310	49 1–6	18¾	4083	§8500
Cruiser No. 4 . . (Protected cruiser)	1887	Ditto	Ditto	315	48½	19 5–24	4324	(§)
Cruiser No. 5 . . (Protected cruiser)	1887	Union Iron Works	Ditto	310	49 1–6	18¾	4083	(§)
Gunboat No. 3 . (Cruiser)	1887	N. F. Palmer, Jr., & Co., Chester, Pa.	Ditto	230	36	14	1700	‡3400
Gunboat No. 4 . (Cruiser)	1887	Ditto	Ditto	230	36	14	1700	‡3400
Dynamite cruiser .	1887	Cramp's	Building	246¼	26 5–12	9	725	(‖)
1st Class torpedo-boat¶	..	Herreshoff's	Awarded	138	14½	3 7–12	99	(**)

* Indicated horse-power on trial.
† Guaranteed.
‡ Guaranteed. Indicated horse-power.
§ Guaranteed speed, 19 knots.

STEEL VESSELS COMPLETED OR BUILDING.

Type of Engines.	Weight of Machinery, &c.	Batteries.		Total Contract Cost of Hull and Machinery.	Date of Act authorizing building.	Contract executed.	Time to Complete from Date of Contract.
		Main.	Secondary.				
				$			Ms.
Single screw vertical compound	411	1 6-in. B. L. R.	2 Gatlings 2 6-pdrs. 4 47*mm* R. C.	315,000	Aug. 5, 1882 Mar. 3, 1883	July 23, 1883	—
Single screw horizontal compound	698	2 8-in. B. L. R. 6 6-in. B. L. R.	2 Gatlings 2 6-pdrs. 2 3-pdrs. 2 1-pdr. 2 47*mm* R. C. 2 37*mm* R. C.	619,000	Ditto Ditto	Ditto	—
Ditto	698	Same as Boston	Same as Boston.	617,000	Ditto	Ditto	—
Twin-screw, compound overhead beam	930	4 8-in. B. L. R. 8 6-in. B. L. R. 2 5-in. B. L. R.	2 Gatlings 2 6-pdrs. 2 1-pdr. 4 47*mm* R. C. 2 37*mm* R. C.	889,000	Ditto	July 26, 1883	—
Twin-screw horizontal compound	710	2 8-in. B. L. R. 6 6-in. B. L. R.	2 Gatlings 4 6-pdrs. 2 3-pdrs. 1 1-pdr. 4 37*mm* R. C.	1,017,000	Mar. 3, 1885	Dec. 28, 1886	18
Twin-screw horizontal triple expansion	900	4 8-in. B. L. R. 6 6-in. B. L. R.	2 Gatlings 4 6-pdrs. 2 3-pdrs. 1 1-pdr. 4 37*mm* R. C.	1,325,000	Aug. 3, 1886	Dec. 17, 1886	18
Ditto	320	6 6-in. B. L. R.	2 Gatlings 2 6-pdrs. 2 3-pdrs. 1 1-pdr. 2 37*mm* R. C.	455,000	Mar. 13, 1885	Jan. 31, 1887	12
Single screw horizontal compound	130	4 6-in. B. L. R.	2 Gatlings 2 3-pdrs. 1 1-pdr. 2 37*mm* R. C.	247,000	Ditto	Dec. 22, 1886	12
Twin-screw horizontal triple expansion	850	12 6-in. B. L. R.	2 Gatlings 4 6-pdrs. 2 3-pdrs. 1 1-pdr. 4 37*mm* R. C.	1,248,000	Mar. 3, 1885 Mar. 3, 1886	Oct. 27, 1887	24
Ditto	900	Ditto	Same as Baltimore	1,350,000	Mar. 3, 1887	Oct. 27, 1887	24
Ditto	900	12 6-in. B. L. R.	Ditto	1,428,000	Ditto	Oct. 26, 1887	24
Ditto	340	Same as No. 1	Same as No. 1	490,000	Ditto	Nov. 15, 1887	18
Ditto	340	Ditto	Ditto	490,000	Ditto	Nov. 15, 1887	18
Twin-screw vertical, triple expansion	247	3 dynamite guns, 10½-in. calibre	2 Gatlings 2 3-pdrs. 1 1-pdr. 2 37*mm* R. C.	Including dynamite guns, &c., 350,000	Aug. 3, 1886	Feb. 11, 1887	12
Twin-screw vertical, quadruple expansion	47	4 automobile torpedoes	2 3-pdrs.	82,750	Aug. 3, 1886	—	—

‖ Guaranteed speed, 20 knots.

¶ Have given data here of the Herreshoff bid.

** Estimated, 23 knots.

Armour-clads and Monitors.

By the Act of August 3, 1886, the Department was authorized to construct two armourclad vessels, each of about 6000 tons, and each to cost, exclusive of armament, not exceeding 2,500,000 dollars.

One of these vessels will be built upon the plans of the Department, and one upon those of the successful competitor, the Barrow Shipbuilding Company. The completion of the double-turreted monitors will be somewhat delayed from the necessity of obtaining the armour from the Bethlehem Iron Company under the contract referred to heretofore. Meanwhile, the matter is receiving careful attention. It is not deemed desirable to order work begun upon these vessels in the Navy yard until they can be pushed to completion.

Coast and Harbour Defence.

Congress at its last session appropriated the sum of 2,000,000 dollars for coast and harbour defence vessels. This is the only appropriation heretofore made for a new Navy, the disposition of which has not as yet been determined by the Department. Bids were opened upon November 1 last for the construction of one first-class torpedo boat, and two bids were found to have been received; one from the Herreshoff Company of Rhode Island, and one from the Vulcan Ironworks of Chicago. As both offer ample guarantees, and the plans submitted with the bids in each case are satisfactory, both offers may be accepted. If so, one will be paid for out of the appropriation for harbour defence boats. Beyond this the Department is not disposed to go with the construction of these unprotected torpedo boats. It is believed that at present the facts are against them.

They are of value only upon occasions when they are invisible to an enemy. Such occasions are rare. This should rule them out as a reliable weapon for coast and harbour defence. A nation cannot select the nights when it will defend its harbours. The occasions when it must are chosen by its adversary.

The foregoing observations only shift the problem a little. The weapon carried by the torpedo boat is the most destructive known. Torpedos—projectiles of all kinds containing high explosives—are incomparably the most powerful known. The abandonment of the unprotected boat does not involve the abandonment of the projectile. The facts concerning the unprotected torpedo boat have not as yet been generally formulated into the conclusions above stated, but a careful study of the facts has brought about a settled conviction upon the subject which will govern the action of this Department.

In what way, then, shall the high explosive projectiles be carried so as to certainly reach the object of attack in spite of machine and rapid-fire guns? One method possibly now taking practical shape is that of the submarine boat. A number of claimants are pressing different devices for these boats. In order to ascertain whether any known and certain results have yet been reached in the progress of this branch of the art, the Department has, with the aid of the Chief of the Bureau of Ordnance, prepared an advertisement inviting all persons who offer to guarantee the results of their work to submit proposals to the Department upon March 1 next. It will serve to sift the claims and may result in an effective and operative submarine torpedo boat. It is reasonably certain that boats entirely submerged, except as to a turret, small and protected against machine gun-fire, are practicable.

The pneumatic dynamite gun is a weapon claiming consideration in this connection. Its range is such as to avoid the necessity of approaching closely to the object of attack; but the Department does not feel authorized to expend anything further upon this weapon until a trial shall have been had of the guns upon the boat now being built. If this trial should be favourable to the gun, it would remove many doubts and difficulties. This will be known within the next few months. If these various devices fail, protected boats can be built of small tonnage, of light draught, proof against machine gun-fire.

To sum up this matter, the Department deems it unwise to follow at present the course of the European Powers in building unprotected torpedo boats. It recognises the power of the dynamite projectile, and believes it practicable to embody it in such manner as to insure that it will reach any desired object of attack in spite of known weapons, and upon that problem it is engaged.

I find myself unable to concur in the recommendation that the single-turreted monitors be repaired and made ready for coast defence vessels. An examination of their characteristics shows that outside of the ships in our own Navy, no antagonist could probably be found against which they could stand for a moment. They were good vessels for their time, but are entirely obsolete.

A first-class modern ironclad could safely anchor, surrounded by these monitors, without any danger or injury to herself, and any one of her guns could send a projectile clean through the monitor from stem to stern. It would be little less than murder to send men in these at the present time to encounter any recently built ironclad. I appreciate fully that it is only as a temporary expedient that it is suggested, and with the thought that in the absence of anything else these might be better than nothing. This has been the theory upon which over fifty, and probably seventy-five millions have been spent since the close of the war. It is time to stop it, and be content only with the best. If every dollar is made to count upon something of real value waste will stop, and not before.

The reduction in the expense of handling and caring for naval stores under the new system of consolidation has been over 25 per cent.

The expenditure required upon the Hartford exceeding the statutory limit, it was decided to suspend work and allow the matter to be re-submitted to Congress. The Tennessee, which has been sold, has had a short life, but as a consumer of money, a brilliant one. She cost originally £378,639, in 1867. Between 1869 and 1875 she had had three months' service, and had cost in repairs and improvements £249,702, an amount largely in excess of a fair price for a warship of her characteristics. On her trial trip she attained a speed of 16 knots, and made a run of 15 knots per hour for four hours. When the boilers built by John Ericsson were taken out, and others substituted by John Roach in 1873, her maximum speed on their trial was 10¾ knots. On April 4, 1887, she was condemned by the Statutory Board as unseaworthy and not worth repairing, and ordered to be sold, having had put upon her between 1875 and 1887 the additional sum of £116,541. She brought £7105 at the auction sale. She had cost the Government £800,000 in round numbers and had done about ten years of active service, outside of repair-shops and Navy yards. It is often a subject of wonder what has become of the £14,500,000 spent upon war-vessels since the close of the war, in view of the fact that there is now no Navy. This bit of history will serve as an illustration.

Naval Reserve.

A public feeling seems to exist for the creation of a Naval Reserve. Committees of the Chambers of Commerce of New York and San Francisco have passed resolutions urging the organization of such a force. Inquiries have also been made at the Department from cities of the Great Lakes, and meetings have been held in cities of the South indorsing the formation of such a national organization. The Department has informed itself fully of the different systems of organization for coast defence and Naval reserves at present in force in foreign countries, and is prepared to formulate a general plan for a similar organization to meet the requirements and conditions of our own institutions. It should resemble in organization that of the militia or national guard, rest upon the foundation of local interest, contemplate the employment and rapid mobilization of steamers enrolled on an auxiliary Navy list, and be calculated to produce the best results upon a comparatively small national expenditure. I ask for this question the earnest consideration of Congress.

Several European Governments make an annual contribution, based on tonnage, to companies constructing new vessels. The consideration to the Government is a counter agreement, permitting the Government to take the vessels for transports in time of war upon terms named in the agreement. The Government officials are also consulted as to her mode of construction, and she goes on to the Naval reserve list. These payments are incidentally in the nature of a subsidy to the shipowner, and this, with their liberal payments for Government transportation of mails, &c., keeps a large fleet of merchantmen afloat as a reserve ready for a time of war. Without ships and trained seamen there can be no Naval reserve.

A notable illustration of the generosity and courage with which England pushes her shipping interest is seen in the manner in which she is at this moment dealing with the trade of the North Pacific. It has been thus far principally under the American flag and contributory to San Francisco and the United States. The British Government and Canada together, are proposing for the establishment of a line of first-class steamers from Vancouver to Japan. The subsidy is likely to be £63,000 annually—£45,000 from England and £15,000 from Canada. There will also be contributed from the Naval reserve fund probably 5 dollars per ton annually for each ship constructed for the route, which will increase the sum by probably £26,400. Under such competition it is quite easy to conjecture what will become of the American flag and our resources in the way of a Naval reserve in the North Pacific.

The facts concerning war-vessels in commission given in the Secretary's report, will be found recorded under our heading of "Naval Vessels in Commission." For the vessels sold, £25,500 was received, £5,900 in excess of their appraised value. As soon as temporary provision can be made at League Island for the marine guard quartered on the Antietam (no longer suitable for that purpose), it is proposed to offer her for sale.

The sales of other Government property amount to £50,000, besides £21,000 to come from the large sales at Portsmouth, Boston, and San Francisco.

It has not been the custom of the Department of late years to specify the forms and characteristics of vessels intended to be built. It has seemed wise to leave the matters to the disposition of Congress. The Department is prepared to proceed with the construction of armourclad vessels, and recommend the commencement of two additional ones to cost, exclusive of armament, not exceeding £1,500,000, one to be built by contract and one in one of the Navy yards. It also asks for authority to build three more fast cruisers of the highest type. Attention is called to the report of the chief constructor, where it is stated that in six years but four of the present cruising ships will remain serviceable. The present Navy, in other words, will have disappeared at that time.

Developments of the year.

The steam trials of the year have indicated the great increase in speed and ratio of power to displacement in vessels recently designed. In some cases this has been obtained by sacrificing many other qualities which are essential in a war-vessel. Among the fastest vessels tried during the year may be mentioned the Dogali, 2000 tons, 19·6 knots, 7600 I.H.P.; Chinese cruisers, 2300 tons, over 19 knots and 6000 I.H.P.; the Undaunted, 5000 tons, 18·9 knots, 8602 I.H.P.; Galatea, 5000 tons, 19 knots, 9200 I.H.P.; Reina Regente, 5000 tons, 20·6 knots mean speed, 11,500 I.H.P.; speed with natural draft, 18·7 knots, I.H.P. 7780.

If the expectations entertained for the new cruisers, 4 and 5, and the Baltimore, now under contract, are realized, it is believed that they will prove as efficient as any other vessels of the same class and date of design. The cruisers in process of construction in France and Germany correspond closely with our new cruisers in size, speed, and battery power. Triple-expansion engines, with high piston speed and systems of forced draft, are now in universal use in all modern war ships. In a few vessels of recent design the number of propellers has been increased to three.

The important developments of the year leading to the early domestic supply of gun forgings, guns, and armour are referred to in detail elsewhere.

Competition among the manufacturers of steel battering shell abroad has produced projectiles giving wonderful although somewhat inconsistent results. One of a lot of 200 Holtzer 12-inch chrome steel shell (ordered by the Admiralty), and recently tried in England, was fired through a new Brown 16-inch compound plate and 10 feet of solid backing, and was stopped by an old armour plate in the rear. The plate was broken in two parts, and cracks were developed over its surface: the frame at the back was broken, and the plate moved back bodily 4 or 5 inches. The projectile was found to be so little deformed that it might have been fired again.

Rapid-fire guns are being rapidly developed and are fast assuming an importance which will permit them to form the principal batteries of certain classes of vessels.

The establishment of the home manufacture of a rapid-fire and revolving cannon is of great importance to the country. Reference is made elsewhere to the contract made with the Hotchkiss Ordnance Company for the manufacture of the Hotchkiss guns in the United States. The manufacture of another gun of the rapid-fire type, the Driggs-Schroeder, of American invention, has been undertaken by a prominent firm. A 3-pounder gun of this model has been built and is now at the Naval Ordnance Proving Ground for trial.

The manufacture of the new brown powder has been successfully developed by Messrs. Du Pont, and the American powder is found upon trial to give results quite as good if not better than those obtained from similar powder purchased abroad.

In Europe the work of constructing fast torpedo boats has remained in the hands of private builders. The unprecedented speed of 26·18 knots has been attained by the Ariete, a 147-foot twin-screw boat built by Thornycroft and Co. for the Spanish Admiralty. Messrs. Yarrow and Co. have also completed two single-screw 135-foot boats for the same Government, named the Azor and Halcon, which on trial, carrying 17 tons, recently developed, respectively, 24 and 23½ knots, which is the best result attained so far by boats of that size. Earlier in the year this firm also built for Italy two twin-screw boats 140 feet long, of 100 tons displacement, which made 24·96 and 25·1 knots for six runs over the measured mile.

Other firms in England and many prominent ones on the Continent continue to supply remarkably fast and able boats.

During the present year there is a falling off in the number built, but this is partly due to the fact that heavy orders given to different firms in 1886 have been nearly all filled, and more particularly because professional opinion has apparently succeeded in making itself heard in condemnation of most of the torpedo boats heretofore built. The verdict is that in order to obtain the remarkable speeds called for by the conditions of modern warfare, these vessels have been built of too light and delicate construction, and a greater tonnage is desirable for those intended for service on the high seas. The tendency now is to exceed lengths of 130 feet and to arm the boats efficiently with machine and rapid-fire guns for self-defence against others specially fitted to attack them. The French Ouragan, 151 feet long, and the Yarrow and Thornycroft, 140 and 147-foot boats, and the still larger "turnabout" boats of J. S. White, constitute a type now being studied; but it seems probable that for actual sea service proper they will attain a size corresponding to the Rattlesnake type in England, Bombe in France, Destructor in Spain, Ilyen in

Russia—that is of 300 to 600 tons displacement, which brings them more properly within the domain of torpedo vessels. Smaller boats will be built of such size as to be useful for harbour defence, and to be carried by the larger vessels of the Fleet. Of these a type is being produced capable of steaming at the rate of 17 knots an hour, and yet weighing only 11½ tons, and suitable for the general service of a ship in times of peace.

In view of the great number of machine and rapid-fire guns now carried, the question is also being raised whether a partial protection of the motive machinery is not essential. The first step in this direction has been taken by the Japanese Government, who have lately received from Yarrow and Co. a 166-foot boat, in which the boilers are covered by 1-inch steel armour. This will prove inadequate as against the latest developments of machine guns. The result of the last year's consideration of the question is that the torpedo boat has lost ground.

The transportation of torpedo boats across country by rail has lately been effected in France in a manner full of tactical interest. This feature commends itself as possessing peculiar interest in the United States.

While first-class torpedo boats are found to be too small for efficient service at sea, those for harbour defence are yet so large as to lose the valuable feature of invisibility, and many authorities are beginning to maintain that these should have the power of going under water if required.

But three finished torpedoes have been presented to the Torpedo Board by inventors, viz. the Patrick torpedo, the Howell torpedo, and the Hall torpedo. Some preliminary trials of the Patrick torpedo have been made before the board, and a programme of further trials submitted. This torpedo of American invention has great promise and should be encouraged. Trials with the other torpedoes have not as yet been made, as the owners have not announced themselves ready.

Special attention is called to the following recommendations in the annual reports: For additional facilities for Naval work on the Pacific coast, especially in the neighbourhood of Puget Sound, and the establishment of a Naval station in the Gulf. For an appropriation to complete the six cannon required for the Chicago, Boston, Atlanta and Dolphin, and for supplying a modern armament for four of the present third-rates. An important arrangement has been made with the Hotchkiss Company for furnishing 90 Hotchkiss guns of various calibres, with ammunition, on the condition that the work should be done in the United States. This action will result in the permanent establishment of a new and most useful branch of manufacture in this country. Consideration has also been given to the improvement of fuses and small arms, and at the instance of the Bureau a new sample revolver has been designed, embodying several special features, which is now under examination. Special attention is also called to the recommendation for new modern vessels, for the training squadron and the establishment of a swimming school; for an engineer assistant to the chief of the Bureau of Steam Engineering and an assistant chief for the Bureau of Construction; for legislation to improve the condition and advantages of the Medical Corps of the Navy. The Secretary recommends that the number of officers of the Marine Corps be increased, and that 500 enlisted men be added to the corps. Also that quarters be provided for the men on the Antietam.

MERCHANT NAVIES OF PRINCIPAL MARITIME COUNTRIES.

TONNAGE of the MERCHANT NAVIES of the British Empire, the United UNITED STATES, in each of the Years, 1820, 1830,

COUNTRIES.	1820.	1830.	1840.	1850.
	Tons.	Tons.	Tons.	Tons.
British Empire* (including United Kingdom) .	2,648,593	2,531,819	3,311,538	4,232,962
United Kingdom	.. ..	.. ..	2,724,107	3,504,944
Russia	.. ..	.. ..	.. ..	.. ..
Finland	.. ..	.. ..	.. ..	.. ..
Norway	.. ..	169,197	276,697	298,315
Sweden	.. ..	.. ..	.. ..	.. ..
Denmark	.. ..	.. ..	.. ..	.. ..
Hamburg	.. ..	.. ..	.. ..	71,257
Bremen	17,283	20,206	43,647	67,770
Total German Empire	.. ..	.. ..	.. ..	.. ..
Holland	.. ..	.. ..	.. ..	292,576
Belgium	.. ..	.. ..	22,610	34,919
France	.. ..	.. ..	662,500	688,153
Italy †	.. ..	.. ..	.. ..	.. ..
Austro-Hungarian Empire ‡	.. ..	.. ..	.. ..	.. ..
Greece	.. ..	.. ..	.. ..	.. ..
United States: §				
Registered for Oversea (Foreign Trade) .	.. ..	576,475	899,765	1,585,711
Enrolled and Licensed (including Lake and River Steamers). ‖	.. ..	591,447	1,240,860	1,899,555

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* In consequence of steps taken to clear the British Register in and since 1854, and in consequence of alterations in the system of measurement, the British tonnage since 1854, as compared with previous years, is a great deal less than it would have appeared to be if the old plan of taking the figures had continued.

† The returns for Italy do not include the province of Venetia previous to the year 1870, nor of Rome previous to 1875. Small coasting vessels and fishing boats are also not included after the year 1870.

Kingdom, the other PRINCIPAL MARITIME COUNTRIES of EUROPE, and the 1840, 1850, 1860, 1870, 1875, and 1877–86.

1860.	1870.	1875.	1877.	1878.	1879.	1880.	1881.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
5,710,968	7,149,134	7,744,237	8,133,837	8,329,421	8,462,364	8,447,171	8,575,560
4,586,742	5,617,693	6,087,701	6,336,360	6,492,121	6,521,289	6,519,772	6,641,267
.. ..	.. ..	.. ..	340,202	382,554	459,280	467,884	..
.. ..	.. ..	300,721	303,319	303,645	284,652	272,308	274,826
558,927	1,022,515	1,419,308	1,493,041	1,526,689	1,510,669	1,518,658	1,520,404
.. ..	346,862	507,049	529,945	536,610	530,803	542,642	529,613
.. ..	178,646	244,100	252,062	251,209	251,958	249,466	253,409
142,416	184,496	219,567	223,910	219,861	245,709	244,279	270,055
121,863	171,654	182,073	216,032	234,718	260,769	270,209	280,088
.. ..	982,355	1,084,882	1,117,935	1,129,129	1,171,286	1,182,097	1,194,407
433,922	389,614	410,689	365,256	358,995	347,665	328,281	305,046
33,111	30,149	50,186	48,405	60,708	71,191	75,666	77,840
996,124	1,072,048	1,028,228	989,128	975,883	932,853	919,298	914,373
.. ..	1,012,164	1,044,337	1,068,449	1,029,157	1,005,972	999,196	989,057
.. ..	329,377	290,450	283,189	286,078	282,571	290,971	286,556
263,075	404,063	262,032	..	..	..	..	..
2,546,237	1,516,800	1,553,827	1,611,193	1,629,047	1,491,533	1,352,810	1,335,586
2,752,938	2,677,940	3,299,905	2,631,407	2,583,718	2,678,068	2,715,224	2,722,148

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‡ Including the vessels trading on the Danube. Excluding small coasting vessels and fishing boats.

§ Years ended 30th June. The tonnage for 1870 and subsequent years is new admeasurement.

|| Registered tonnage is that employed in the foreign trade. Enrolled and licensed is that employed in the river, lake, and home trade.

TONNAGE of the MERCHANT NAVIES of the British Empire, the United Kingdom, the other PRINCIPAL MARITIME COUNTRIES of EUROPE, and the UNITED STATES, in each of the Years 1820, 1830, 1840, 1850, 1860, 1870, 1875, and 1877–86—*continued.*

COUNTRIES.	1882.	1883.	1884.	1885.	1886.
	Tons.	Tons.	Tons.	Tons.	Tons.
British Empire * (including United Kingdom)	8,796,517	9,131,418	9,314,496	9,323,615	9,246,051
United Kingdom	6,908,650	7,196,401	7,363,707	7,387,208	7,321,335
Russia	..	500,554	..	..	..
Finland	283,105	..	..	..	..
Norway	1,530,004	1,547,194	1,583,434	1,563,020	..
Sweden	527,456	519,640	529,585	517,061	..
Denmark	256,858	266,396	281,343	278,738	..
Hamburg	288,236	307,338	319,923	322,235	..
Bremen	299,397	307,559	319,465	319,213	..
Total German Empire . . .	1,226,650	1,269,477	1,294,288	1,282,449	..
Holland	302,790	309,764	308,339	302,769	..
Belgium	82,647	86,360	80,592	84,862	..
France	983,017	1,003,679	1,033,829	1,000,215	..
Italy †	990,004	973,333	971,001	953,419	..
Austro-Hungarian Empire ‡ . .	288,011	280,184	281,346	269,763	..
Greece.	..	..	261,496	..	..
United States : §					
Registered for Oversea (Foreign Trade)	1,292,294	1,302,095	1,304,221	1,287,999	1,111,179
Enrolled and Licensed (including Lake and River Steamers) ‖ .	2,873,639	2,933,392	2,967,008	2,977,935	3,020,957

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* In consequence of steps taken to clear the British Register in and since 1854, and in consequence of alterations in the system of measurement, the British tonnage, since 1854, as compared with previous years, is a great deal less than it would have appeared to be if the old plan of taking the figures had continued.

† The returns for Italy do not include the province of Venetia previous to the year 1870, nor of Rome previous to 1875. Small coasting vessels and fishing boats are also not included after the year 1870.

‡ Including the vessels trading on the Danube. Excluding small coasting vessels and fishing boats.

§ Years ended 30th June. The tonnage for 1870 and subsequent years is new admeasurement.

‖ Registered tonnage is that employed in the foreign trade. Enrolled and licensed is that employed in the river, lake, and home trade.

TONNAGE of SHIPPING added to the MERCHANT NAVIES of the UNITED KINGDOM and the other PRINCIPAL MARITIME COUNTRIES of EUROPE, in each of the Years 1850, 1860, 1870, 1875, and 1877–86.

COUNTRIES.	1850.	1860.	1870.	1875.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
United Kingdom*	133,695	301,535	391,831	502,585	493,932	464,511	410,804	411,736	561,750	714,521	751,950	549,896	423,711	323,897
Norway . . .	11,115	20,884	69,415	118,394	97,289	63,943	53,433	71,427	78,748	74,776	88,311	84,896	69,421	..
Sweden . . .	..	..	25,434	30,039	17,860	13,990	10,550	13,152	18,274	15,171	18,201	26,237	17,458	..
Denmark . .	..	..	..	27,836	13,675	11,245	9,702	12,273	18,455	17,146	20,259	17,654	9,197	..
Germany . .	..	..	..	72,709	67,768	73,356	90,490	80,827	88,537	118,738	128,145	85,919	44,179	..
Holland . .	18,572	11,866	19,406	21,882	16,055	22,238	18,178	14,690	18,883	23,777	27,560	17,032	13,433	..
France . . .	44,032	43,823	63,372	64,209	50,900	44,859	43,728	46,830	55,644	135,206	84,610	77,634	25,611	..
Italy . . .	..	..	106,162	88,678	44,884	39,080	40,497	31,863	41,090	43,548	41,055	36,619	30,165	..

Note.—By tonnage of shipping added, is meant the addition to the register of vessels, whether new built or bought abroad. The above figures represent, therefore, the gross and not the net increase of the merchant Navy of each country.

* The figures for the new tonnage added to the Register in the United Kingdom as given above relate to British-built vessels only in the year 1850, and to all vessels, whether British, Foreign, or Colonial-built, added to the Register in subsequent years.

TONNAGE of STEAM VESSELS belonging to the MERCHANT NAVIES of COUNTRIES of EUROPE, and the UNITED STATES, in each

COUNTRIES.	1840.	1850.	1860.	1870.	1875.	1878.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
British Empire * .	95,807	187,631	500,144	1,202,134	2,072,804	2,492,327
United Kingdom .	87,539	167,698	452,852	1,111,375	1,943,197	2,313,332
Russia	.. ..	.. ..	.. ..	.. ..	.. ..	74,324
Finland	.. ..	.. ..	.. ..	.. ..	7,400	9,724
Norway	.. ..	.. ..	.. ..	13,715	45,965	51,674
Sweden	.. ..	.. ..	.. ..	.. ..	83,007	82,119
Denmark	.. ..	.. ..	.. ..	10,453	39,368	46,623
Hamburg	.. ..	2,842	10,184	32,450	89,730	75,040
Bremen	.. ..	.. ..	8,483	41,393	55,319	59,902
Total German Empire .	.. ..	.. ..	.. ..	81,994	183,569	179,662
Holland	.. ..	2,706	10,132	19,455	59,925	59,473
Belgium . . .	1,048	1,604	4,254	9,501	35,430	50,389
France . . .	9,535	13,925	68,025	154,415	205,420	245,898
Italy †	.. ..	.. ..	.. ..	32,100	57,147	63,020
Austro-Hungarian Empire.	.. ..	.. ..	.. ..	49,977	56,271	57,003
Greece	.. ..	.. ..	.. ..	5,360	8,241	..
United States: ‡						
Registered for Oversea (Foreign Trade).	4,155	44,942	97,296	192,544	191,689	170,838
Enrolled and Licensed (including Lake and River Steamers). §	198,184	481,005	770,641	882,551	976,979	996,840

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* In consequence of steps taken to clear the British Register in and since 1854, and of alterations in the system of measurement, the British tonnage, since 1854, as compared with the previous years, is a great deal less than would have appeared if the old plan of taking the figures had continued.

† The returns for Italy are exclusive of the Roman States previous to 1875.

the British Empire, the United Kingdom, the other PRINCIPAL MARITIME of the Years 1840, 1850, 1860, 1870, 1875, and 1878–86.

1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
2,733,269	2,949,282	3,239,508	3,571,078	4,013,677	4,249,442	4,293,115	4,318,153
2,508,102	2,720,551	3,001,377	3,331,895	3,725,229	3,941,056	3,969,728	3,961,746
91,020	88,990	.. ..	.. ..	99,214	..	..	..
10,037	10,498	9,973	10,958	..	..	..	..
54,781	58,062	65,627	82,519	92,485	105,638	114,108	..
83,659	81,049	79,245	87,524	95,276	107,831	110,151	..
48,799	51,957	61,426	70,706	81,042	90,710	89,815	..
92,237	99,153	128,891	149,774	173,542	186,311	188,296	..
59,462	58,666	60,676	75,702	89,046	101,893	101,256	..
196,843	215,758	251,648	311,204	374,699	413,943	420,605	..
58,653	64,394	72,224	85,273	101,667	110,050	108,422	..
59,536	65,224	70,486	75,897	79,902	74,667	79,809	..
255,959	277,759	311,779	416,228	467,488	511,072	492,396	..
72,666	77,050	93,698	104,719	107,452	122,297	124,600	..
58,604	62,743	65,755	78,433	76,780	79,396	82,171	..
..	..	..	..	..	36,272	..	..
156,323	146,604	152,769	154,570	171,905	184,188	186,406	176,633
1,019,849	1,064,954	1,112,229	1,201,255	1,241,289	1,281,721	1,308,511	1,346,351

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‡ Years ended 30th June. The tonnage for 1870 and subsequent years is all new admeasurement.

§ The "enrolled and licensed" tonnage of the United States is confined to the home and river trades, and is prohibited by law from going on a foreign voyage.

TONNAGE of VESSELS BUILT in the UNITED KINGDOM, in each Year from 1858 to 1886.

Years.	For Home and the Colonies.			For Foreigners.			Total.		
	Sailing.	Steam.	Total.	Sailing.	Steam.	Total.	Sailing.	Steam.	Total.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1858	154,930	53,150	208,080	1,518	26,956	28,474	156,448	80,106	236,554
1859	147,967	38,003	185,970	3,402	23,872	26,774	151,369	61,375	212,744
1860	158,172	53,796	211,968	..	13,903	13,903	158,172	67,699	225,871
1861	129,970	70,869	200,839	232	7,255	7,487	130,202	78,124	208,326
1862	164,061	77,338	241,399	..	20,533	20,533	164,061	97,871	261,932
1863	253,036	107,951	360,987	1,084	16,236	17,320	254,120	124,187	378,307
1864	272,499	159,374	431,873	2,279	26,681	28,960	274,778	186,055	460,833
1865	235,555	179,649	415,204	949	32,016	32,965	236,504	211,665	448,169
1866	207,678	133,511	341,189	3,641	34,709	38,350	211,319	168,220	379,539
1867	174,507	94,573	269,080	4,994	31,905	36,899	179,501	126,478	305,979
1868	237,687	78,510	316,197	8,671	37,460	46,131	246,358	115,970	362,328
1869	230,762	123,525	354,287	11,800	22,005	33,805	242,562	145,530	388,092
1870	117,032	225,674	342,706	9,429	42,222	51,651	126,461	267,896	394,357
1871	56,545	297,810	354,355	3,715	32,988	36,703	60,260	330,798	391,058
1872	54,967	338,004	392,971	3,790	77,957	81,747	58,757	415,961	474,718
1873	88,532	282,134	370,666	1,094	81,783	82,877	89,626	363,917	453,543
1874	187,313	333,890	521,203	1,781	80,883	82,664	189,094	414,773	603,867
1875	241,646	178,905	420,551	3,711	47,796	51,507	245,357	226,701	472,058
1876	236,890	123,475	360,365	4,198	13,457	17,655	241,088	136,932	378,020
1877	212,320	221,330	433,650	2,194	15,075	17,269	214,514	236,405	450,919
1878	141,165	287,080	428,245	7,108	35,366	42,474	148,273	322,446	470,719
1879	59,115	297,720	356,835	2,464	46,692	49,156	61,579	344,412	405,991
1880	57,480	346,361	403,841	585	68,470	69,055	58,065	414,831	472,896
1881	92,420	408,764	501,184	1,348	106,346	107,694	93,768	515,110	608,878
1882	145,700	521,575	667,275	2,139	113,637	115,776	147,839	635,212	783,051
1883	146,818	621,758	768,576	1,272	122,368	123,640	148,090	744,126	892,216
1884	162,234	335,208	497,442	10,945	79,887	90,832	173,179	415,095	588,274
1885	208,411	196,975	405,386	10,683	24,943	35,626	219,094	221,918	441,012
1886	138,362	154,638	293,000	6,887	31,641	38,528	145,249	186,279	331,528

Including the following, built for War purposes for Foreigners :—

Years.	Sailing.	Steam.	Total.	Years.	Sailing.	Steam.	Total.
	Tons.	Tons.	Tons.		Tons.	Tons.	Tons.
1864	..	6,497	6,497	1876	..	14	14
1865	..	3,700	3,700	1877	..	3,435	3,435
1866	..	10,301	10,301	1878	..	2,482	2,482
1867	..	3,604	3,604	1879	..	716	716
1868	1,117	9,137	10,254	1880	..	385	385
1869	..	2,354	2,354	1881	..	5,338	5,338
1870	..	970	970	1882	..	447	447
1871	..	80	80	1883	..	270	270
1872	..	40	40	1884	..	2,339	2,339
1873	..	280	280	1885	..	5,462	5,462
1874	..	12,877	12,877	1886	..	840	840
1875	..	12,280	12,280				

Note.—The Returns for the years prior to 1871 denote the tonnage of the newly-built vessels which were *first registered* in those years, but in the Returns for that and the following years the tonnage of vessels, the building of which was completed in those years, is given, whether registered or not.

TONNAGE of VESSELS BUILT in FRANCE, Bought Abroad, and Sold to Foreigners in each Year from 1855 to 1885.

Years.	Tonnage of Vessels Built.	Tonnage of Vessels Bought Abroad.	Tonnage of Vessels Sold to Foreigners.
	Tons.	Tons.	Tonnage.
1855	103,488		1,919
1856	174,018		2,414
1857	116,910		4,318
1858	66,427		10,910
1859	87,216		9,404
1860	43,192		13,182
1861	45,100		10,354
1862	52,444		8,760
1863	59,467		9,625
1864	64,670		6,856
1865	76,817		4,907
1866	75,990		3,982
1867	81,127		4,914
1868	68,983		5,298
1869	73,878		2,811
1870	62,805		11,135
1871	58,541		16,341
1872	50,697	34,885	17,865
1873	39,430	17,646	19,848
1874	34,917	17,404	27,092
1875	37,520	20,001	14,722
1876	32,707	15,581	16,148
1877	26,884	12,864	14,751
1878	21,367	19,677	12,851
1879	24,733	16,809	8,323
1880	12,629	34,201	12,939
1881	20,735	34,909	11,441
1882	56,594	78,612	17,407
1883	35,223	49,387	14,681
1884	57,162	20,472	11,814
1885	15,930	9,681	20,852

STATISTICS RELATING TO THE POPULATION AND TRADE OF THE UNITED KINGDOM, INDIA, AND THE COLONIES.

AREA and POPULATION of COLONIAL and other POSSESSIONS.

Possessions.	Area.	Population. 1871. Males.	1871. Females.	1871. Total.	1881. Males.	1881. Females.	1881. Total.	1885. Males.	1885. Females.	1885. Total.
	Square Miles.									
India (British) *a* . .	868,314	..	..	191,018,412	101,292,504	97,498,349	198,790,853	—	—	—
Straits Settlements . .	1,472	200,433	107,664	308,097	281,687	141,697	423,384	410,000	188,000	598,000
Ceylon	25,365	1,285,885	1,120,377	2,406,262	1,473,515	1,290,469	2,763,984	—	—	—
Mauritius	713	201,164	128,590	329,754*b*	218,121	159,252	377,373*b*	211,361	150,043	361,404*b*
Labuan	30	3,027	1,871	4,898	3,927	2,371	6,298	—	—	—
Hong Kong . . .	30·5	90,435	33,763	124,198	115,369	45,033	160,402	137,079	53,515	190,594
Australasia :—										
New South Wales . .	311,098	275,551	228,430	503,981	411,149	340,319	751,468	548,070	432,503	980,573
Victoria	87,884	401,050	330,478	731,528	452,083	410,263	862,346	529,710	462,159	991,869
South Australia . .	903,690	95,408	90,218	185,626	149,530	130,335	279,865*c*	164,877†	147,904†	312,781†
Western Australia . .	1,060,000	15,565	9,788	25,353	17,062	12,646	29,708	19,989	15,197	35,186
Tasmania . . .	26,215	53,911	47,874	101,785	61,162	54,543	115,705	71,081	62,710	133,791
New Zealand . . .	104,458	150,356	106,037	256,393*d*	269,605	220,328	489,933*d*	316,025	266,395	582,420*d*
Queensland . . .	668,497	71,767	48,337	120,104	125,325	88,200	213,525	191,450	135,466	326,916
Total . .	3,161,842	1,063,608	861,162	1,924,770	1,485,916	1,256,634	2,742,550	1,841,202	1,522,334	3,363,536
Fiji *e*	7,740	..	..	..	70,248	56,847	127,095	69,860	57,419	127,279
Falkland Isles . . .	6,500	584	229	811*f*	976	577	1,553	—	—	—
Natal	18,750	146,756	143,017	289,773	191,376	203,814	402,687*g*	212,833	230,806	443,639
Cape of Good Hope *h* . .	213,636	255,760	240,621	582,582*i*	369,628	351,356	720,984*k*	..	..	1,252,347 *l*
St. Helena	47	2,999	3,242	6,241	2,573	2,486	5,059	—	—	—
Lagos	1,069	28,963	33,058	62,021	37,665	37,605	75,270	—	—	—
Gold Coast. . . .	18,784 *m*	..	..	408,070	Not ascertained			..	..	651,000*m*
Sierra Leone . . .	3,000 *m*	..	..	..	31,201	29,345	60,546	—	—	—
Gambia	69	7,306	6,884	14,190	7,215	6,935	14,150	—	—	—
North America :—										
Dominion of Canada :										
Ontario and Quebec . .	337,965	1,424,631	1,387,736	2,812,367	1,654,645	1,627,610	3,282,255	1,756,908	1,734,972	3,491,880
New Brunswick . .	27,322	145,888	139,706	285,594	164,119	157,114	321,233	172,032	164,670	336,702
Nova Scotia . . .	21,731	193,792	194,008	387,800	220,538	220,084	440,572	232,245	231,395	463,640
Manitoba	73,720	..	..	12,228	37,207	28,747	65,954	—	—	—
Prince Edward Island .	2,133	47,121	46,900	94,021	54,729	54,162	108,891	58,104	57,372	115,476
British Columbia . . Vancouver's Island . .	390,344	..	..	33,586	29,503	19,956	49,459	—	—	—
North-West Territory, &c.	2,665,257	..	..	60,500	28,113	28,333	56,446	..	—	—
Newfoundland ‡ .	42,000	.	..	146,536			179,509	100,849	97,779	198,181†
[illegible]	[illegible]			[illegible]			[illegible]			

Bermuda	19	5,402	6,719	12,121	6,448	7,500	13,948	7,331	7,705	15,036
Honduras	6,400	12,603	12,107	24,710	14,108	13,344	27,452	—	—	—
West India Islands:—										
Bahamas	4,466	19,349	19,813	39,162	20,734	22,787	43,521	—	—	—
Turk's Island	169	2,274	2,449	4,723	2,232	2,500	4,732	—	—	—
Jamaica	4,193	246,573	259,581	506,154	282,957	297,847	580,804	—	—	596,383
Windward Islands:—										
St. Lucia	238	15,532	16,078	31,610	18,973	19,578	38,551	20,340	21,041	41,381
St. Vincent	133	16,865	18,823	35,688	19,047	21,501	40,548	20,096†	22,943†	43,039†
Barbadoes	166	73,452	88,590	162,042	77,253	94,607	171,860	—	—	—
Grenada	133	..	..	37,684	20,074	22,329	42,403	22,125	24,229	46,424
Tobago	114	8,262	8,792	17,054	8,694	9,357	18,051	9,368	9,995	19,363
Leeward Islands:—										
Virgin Islands	57	3,379	3,272	6,651	2,537	2,750	5,287	—	—	—
St. Christopher	65	13,259	14,910	28,169	13,706	15,431	29,137	19,143†	21,858†	41,001†
Nevis	50	5,451	6,252	11,703	5,436	6,428	11,864			
Antigua	170	15,998	19,159	35,157	16,147	18,817	34,964	—	—	—
Montserrat	32	3,978	4,715	8,693	4,639	5,444	10,083	5,185	5,912	11,097
Dominica	291	12,737	14,441	27,178	12,867	15,344	28,211	13,147†	15,693†	28,840†
Trinidad	1,754	60,405	49,233	109,638	83,716	69,412	153,128	..	..	171,914
Total of West India Islands	..	..	..	1,061,306	589,012	624,132	1,213,144	—	—	—
British Guiana	109,000	108,792	84,699	193,491*p*	140,134	112,052	252,186*p*	149,370	120,672	270,042
Gibraltar	1⅞	8,969	9,726	18,695*b*	8,640	9,741	18,381*b*	—	—	—
Malta	119	70,035	71,883	141,918*b*	73,430	76,352	149,782*b*	77,084†	79,591†	156,675†*b*

a. Exclusive of the Feudatory Native States, 509,730 square miles in area, with a population of 55,191,742 persons according to the Census of 1881. *b.* Exclusive of the Military population. *c.* Exclusive of Aborigines. *d.* Exclusive of Maoris, estimated at 37,502 in 1871 and 44,097 in 1881. *e.* The area given is that of the inhabited islands, exclusive of Rotumah. The population figures include Rotumah. *f.* Including 48, sex not distinguished. *g.* Including 3130 coolies and 4367 natives, sex not distinguished. *h.* Inclusive of the territories annexed to Cape Colony proper. *i.* Census of 1865, including British Caffraria, population 86,201, sex not distinguished; but exclusive of the territories. *k.* Census of 1875, including British Caffraria, 3006 square miles, population 122,154; but exclusive of Basutoland, Transkei, and Griqualand West, area 40,158 square miles, population 327,984. *l.* Approximate total population of the Colony and Dependencies. *m.* Estimate, including total area under British jurisdiction. *n.* Census of 1869. *p.* Exclusive of 7000 Aborigines in 1871, but inclusive of 7656 Aborigines in 1881, sex not distinguished. † 1884 figures. Returns not received for 1885. ‡ Exclusive of Labrador, with estimated area of 120,000 square miles, population (1881) 4211.

VALUE of TOTAL IMPORTS from, and of TOTAL EXPORTS

The Exports in this Table include British

COUNTRIES.		1872.	1873.	1874.	1875.	1876.	1877.
FOREIGN:		£	£	£	£	£	£
Russia—Northern Ports	Imports	11,764,443	13,660,041	15,094,381	13,068,883	12,363,568	18,925,959
	Exports	7,377,288	8,920,498	9,548,936	9,624,847	7,091,384	5,856,301
——— Southern Ports	Imports	12,555,890	7,529,290	5,839,010	7,640,018	5,210,920	3,216,463
	Exports	2,091,684	2,624,733	2,316,351	1,721,469	1,544,271	387,672
Sweden and Norway	Imports	9,091,307	10,686,777	11,393,547	8,918,638	10,654,311	10,454,475
	Exports	4,854,837	6,972,999	7,057,222	6,296,995	6,323,606	6,197,099
Denmark Proper, and Iceland .	Imports	3,618,337	3,571,139	3,890,492	4,241,671	4,217,934	3,950,229
	Exports	2,374,946	3,054,688	2,873,898	2,756,145	2,598,707	2,332,911
Danish West Indies	Imports	43,567	10,454	58,231	38,291	9,585	14,676
	Exports	479,115	370,006	357,968	395,386	272,743	236,688
Germany . . .	Imports	19,231,873	19,926,451	19,947,195	21,836,401	21,115,189	26,269,993
	Exports	43,150,207	36,709,419	35,127,617	34,121,624	29,734,684	28,950,333
Holland . . .	Imports	13,108,473	13,272,444	14,464,158	14,836,648	16,602,154	19,861,254
	Exports	24,336,156	24,578,380	21,289,635	20,113,787	18,707,800	16,032,626
——— Java & other Possessions in the Indian Seas.	Imports	733,281	436,163	1,311,939	1,442,607	1,440,860	1,955,586
	Exports	771,822	774,673	1,299,556	1,753,517	1,690,223	2,088,775
Belgium . . .	Imports	13,211,044	13,075,186	15,048,865	14,822,240	13,848,293	12,888,774
	Exports	13,099,927	14,230,511	12,653,342	13,794,770	12,835,641	11,759,867
France	Imports	41,803,444	43,339,234	46,518,571	46,720,101	45,304,854	45,823,324
	Exports	28,292,445	30,196,168	29,389,241	27,292,455	29,000,273	25,663,602
——— Algeria .	Imports	358,618	438,784	517,144	500,185	495,848	562,126
	Exports	91,659	65,565	48,182	163,217	212,975	275,920
——— Possessions in Senegambia	Imports	..	..	..	..	..	..
	Exports	12,164	18,450	21,613	19,641	19,882	33,195
——— Possessions in India .	Imports	35,637	32,663	12,131	53,732	38,649	4,840
	Exports	..	..	..	7,332	18,086	15,119
Portugal . . .	Imports	4,119,363	4,329,806	4,265,032	4,444,071	3,361,071	3,776,795
	Exports	2,677,308	3,338,033	3,128,332	3,081,905	2,726,509	2,872,638
——— Azores and Madeira	Imports	424,289	331,288	418,259	340,360	443,519	312,138
	Exports	210,423	522,144	375,749	233,262	207,935	200,205
Spain	Imports	9,316,820	10,973,231	8,641,639	8,660,953	8,763,146	10,842,097
	Exports	4,309,307	4,527,817	5,030,174	4,294,490	4,796,498	4,267,214
—— Canary Islands .	Imports	431,118	430,898	393,779	424,459	276,552	297,201
	Exports	244,505	252,878	223,499	216,552	159,379	184,393
—— Fernando Po	Imports	22,947	54,898	19,138	27,567	16,177	21,207
	Exports	19,151	30,324	16,491	7,813	12,992	15,047
—— West India Islands .	Imports	5,231,543	5,109,259	3,764,587	3,668,776	2,943,385	1,505,245
	Exports	3,475,280	3,154,337	2,322,061	2,997,722	2,572,378	2,715,169
—— Philippine Islands .	Imports	1,376,085	1,420,009	1,417,989	1,559,500	1,442,556	1,755,934
	Exports	410,718	439,174	469,418	939,983	736,630	1,314,169
Italy	Imports	4,159,161	3,831,091	3,634,360	4,632,619	4,152,201	4,100,812
	Exports	7,715,888	8,571,687	7,763,644	8,169,804	8,129,036	7,349,337

to, the various FOREIGN COUNTRIES and BRITISH POSSESSIONS.

and Foreign and Colonial Produce.

1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
£	£	£	£	£	£	£	£	£
12,352,193	11,063,115	12,497,004	10,229,568	13,397,362	13,799,033	11,199,297	10,934,926	8,539,362
7,974,734	9,205,303	9,414,306	7,875,944	7,366,063	6,459,993	6,435,249	5,295,754	5,008,062
5,451,659	4,813,470	3,532,691	3,823,653	7,650,360	7,177,149	5,116,114	6,777,500	5,032,424
1,483,995	1,401,780	1,553,211	1,401,494	1,271,505	1,169,890	1,153,807	944,939	1,400,473
9,127,397	8,392,723	10,989,000	10,054,051	11,758,635	11,834,314	10,529,115	10,941,590	10,227,401
4,324,333	3,928,682	5,132,408	5,037,236	5,107,502	5,410,972	5,304,429	5,105,502	4,500,688
4,584,544	4,675,090	5,285,767	4,611,999	5,249,467	6,254,998	5,248,244	4,829,515	4,936,992
1,900,135	1,984,767	2,347,573	2,431,193	2,489,182	2,597,807	2,600,591	2,254,089	2,107,532
59,757	35,921	70,295	43,221	100,650	45,696	38,399	16,878	14,051
253,150	214,927	217,744	193,149	208,141	191,681	162,696	115,918	98,994
23,570,836	21,604,890	24,355,419	23,650,285	25,570,985	27,907,626	23,620,682	23,069,163	21,422,342
29,169,665	29,623,776	29,055,844	29,276,914	30,524,652	31,781,370	30,789,123	27,059,830	26,302,267
21,465,591	21,959,384	25,909,373	23,022,985	25,320,709	25,115,586	25,876,898	25,009,582	25,309,949
14,676,125	15,452,752	15,654,364	15,272,429	16,252,104	15,872,330	18,230,089	15,849,466	15,011,501
1,850,643	1,784,140	2,236,585	2,662,872	3,744,454	4,091,013	3,185,582	3,055,496	3,162,478
1,680,082	1,657,451	1,767,796	1,759,072	1,968,224	2,805,170	2,330,274	1,778,395	1,424,833
12,386,625	10,725,739	11,253,664	11,510,388	14,932,674	16,178,345	15,146,175	15,070,121	14,248,151
11,355,569	11,887,442	12,987,430	13,537,445	15,117,213	14,755,012	14,780,522	13,876,556	12,250,911
41,378,896	38,459,096	41,970,298	39,984,187	39,090,381	38,636,022	37,437,014	35,709,787	36,599,450
26,595,958	26,558,333	27,990,959	30,085,661	29,758,427	29,409,335	26,339,443	28,020,350	20,319,010
357,352	454,246	741,453	750,858	695,224	879,793	832.559	885,621	701,398
173,567	229,614	299,898	292,960	324,360	357,016	391,372	362,961	275,632
340	..	6,119	4,030	15,389	16,394	17,808	13,237	15,788
33,878	51,988	56,444	78,032	72,880	93,048	213,687	201,104	62,098
488	6,845	..	162	24,725	40,343	17,872	18,814	17,759
26,808	23,976	10,915	14,563	4,809	3,753	7,698	9,524	6,758
3,319,968	3,025,228	3,762,504	3,357,012	3,676,054	3,463,500	3,042,517	2,670,855	2,547,901
2,614,945	2,427,118	2,603,318	2,539,977	2,367,979	2,374,590	2,387,166	2,100,917	2,211,421
295,696	215,332	227,595	206,230	223,033	150,069	173,761	174,474	142,584
134,457	137,793	147,733	145,672	167,458	182,529	337,869	159,190	156,805
9,115,394	8,398,776	10,699,936	10,027,505	11,488,265	11,623,663	10,157,885	9,464,627	9,112,025
3,794,734	3,758,717	4,078,597	4,393,821	4,847,662	4,876,243	4,750,746	3,914,836	3,825,472
328,164	340,683	428,320	346,760	244,082	156,026	90,828	95,684	109,852
196,404	229,932	257,681	221,611	136,226	204,716	182,979	199,027	387,147
18,504	14,771	13,923	5,604	7,126	7,301	12,307	10,435	6,620
9,093	9,844	8,429	12,738	11,258	10,507	13,723	11,653	11,263
1,804,872	2,929,826	1,752,635	1,624,498	1,768,637	1,079,494	926,371	984,976	134,935
2,543,742	2,435,890	2,291,858	2,815,386	3,132,460	3,076,467	2,149,623	2,225,979	2,607,485
1,257,739	1,480,821	1,688,663	2,344,404	2,307,117	1,670,076	1,143,195	980,090	796,747
854,601	612,883	1,328,482	1,509,034	1,339,140	1,248,613	1,002,720	979,620	864,608
3,252,459	3,233,594	3,385,109	3,274,881	3,481,325	3,392,446	3,167,943	3,009,499	2,773,573
6,444,666	6,039,778	6,333,240	7,517,734	7,466,675	8,194,823	8,062,965	7,468,000	6,980,637

VALUE of TOTAL IMPORTS from, and of TOTAL EXPORTS to,

COUNTRIES—*cont.*		1872.	1873.	1874.	1875.	1876.	1877.
FOREIGN—*cont.*		£	£	£	£	£	£
Austrian Territories .	Imports	911,607	869,483	799,544	1,318,889	855,798	1,540,980
	Exports	1,946,077	1,815,463	1,435,872	1,177,350	1,111,377	1,397,322
Greece . .	Imports	1,998,153	1,736,643	1,536,805	1,762,301	1,799,377	2,454,001
	Exports	1,044,657	1,107,700	1,173,177	1,147,683	1,000,783	985,794
Roumania* .	Imports	1,044,406	1,024,334	611,745	594,158	1,238,091	247,317
	Exports	925,380	1,171,393	1,365,228	1,163,231	786,838	237,423
Turkey . .	Imports	5,440,529	6,068,925	5,842,846	6,555,714	7,444,323	6,852,108
	Exports	8,170,060	8,120,246	7,496,506	6,346,888	6,379,962	6,005,268
Egypt . .	Imports	16,455,731	14,155,913	10,514,798	10,895,043	11,481,519	11,101,785
	Exports	7,307,960	6,322,461	3,674,259	3,036,284	2,687,402	2,326,968
Morocco . .	Imports	685,940	970,206	699,163	711,294	627,453	811,954
	Exports	292,489	365,364	513,268	420,832	469,101	465,258
United States	Imports	54,663,948	71,471,493	73,897,400	69,590,054	75,899,008	77,825,973
	Exports	45,907,998	36,698,424	32,238,321	25,062,226	20,226,627	19,885,893
Mexico . .	Imports	443,524	499,532	546,651	721,907	662,132	798,857
	Exports	899,538	1,379,873	1,322,876	980,716	576,814	1,071,715
Central America .	Imports	1,126,117	1,363,999	1,120,874	1,308,889	934,772	1,380,361
	Exports	336,284	379,949	175,472	875,597	737,943	972,526
Haiti and St. Domingo .	Imports	389,661	339,002	344,461	448,837	409,961	247,376
	Exports	630,708	578,411	459,964	715,883	378,342	397,337
New Granada (United States of Colombia)	Imports	1,019,235	1,077,233	995,600	962,205	681,913	472,021
	Exports	3,175,286	3,101,207	2,592,156	942,097	802,061	927,460
Venezuela .	Imports	122,621	97,772	50,545	37,136	54,878	63,739
	Exports	547,678	541,620	528,046	765,419	697,821	633,740
Ecuador . .	Imports	243,840	318,161	297,405	233,980	244,517	185,791
	Exports	89,084	109,383	67,370	133,519	229,242	255,618
Brazil . .	Imports	9,450,249	7,399,974	7,003,131	7,418,605	5,178,386	6,344,961
	Exports	7,781,820	7,876,595	8,046,150	7,172,406	6,236,366	6,405,971
Uruguay. .	Imports	1,416,933	1,270,723	1,437,288	1,208,590	841,314	734,699
	Exports	1,918,949	1,866,833	1,304,156	758,094	1,041,819	1,131,536
Argentine Republic .	Imports	1,902,889	2,604,043	1,271,445	1,359,783	1,664,029	1,699,376
	Exports	4,031,939	3,810,237	3,192,322	2,490,604	1,597,498	2,184,033
Chili . .	Imports	5,591,783	4,764,195	4,700,510	4,196,096	3,584,598	3,279,808
	Exports	3,368,503	3,310,102	2,892,485	2,343,950	2,065,190	1,611,166
Peru . . .	Imports	4,211,723	5,219,572	4,501,213	4,884,181	5,630,670	4,696,502
	Exports	3,342,849	2,741,255	1,829,977	1,817,981	1,169,441	1,421,031
China . .	Imports	13,454,326	12,520,460	11,190,903	13,654,722	14,938,641	13,428,032
	Exports	6,870,418	5,017,334	4,852,904	5,096,770	4,719,449	4,611,231
Japan . .	Imports	184,342	561,390	573,136	377,791	657,145	734,399
	Exports	2,146,518	1,884,145	1,364,127	2,593,862	2,191,487	2,460,275
Western Coast of Africa † .	Imports	2,005,617	1,808,609	1,946,013	1,727,765	1,679,760	1,625,603
	Exports	1,329,695	1,369,711	1,176,785	1,027,420	1,235,922	1,428,252
Other Countries .	Imports	1,920,357	1,576,532	1,387,939	1,674,946	1,613,070	1,800,913
	Exports	920,896	936,873	726,086	885,784	893,893	1,029,773
TOTAL OF FOREIGN COUNTRIES	Imports	275,320,771	290,277,250	287,919,862	289,515,606	290,822,127	304,865,684
	Exports	248,979,616	239,857,058	219,740,436	204,957,312	186,626,713	176,593,870

* Wallachia and Moldavia from 1872 to 1878 and Roumania from 1879.

he various Foreign Countries and British Possessions—*continued.*

1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
£	£	£	£	£	£	£	£	£
1,665,857	1,685,602	1,430,949	1,390,001	2,014,523	2,337,896	1,843,238	2,157,570	1,621,515
1,089,372	1,047,045	828,971	892,567	1,118,067	1,545,260	1,408,631	1,120,254	1,343,448
1,763,064	1,861,196	1,483,462	2,162,566	1,849,597	1,905,635	2,015,277	1,912,804	1,545,798
1,130,206	1,081,437	918,038	1,277,570	1,223,638	1,442,454	1,344,666	972,937	1,083,746
970,555	1,373,002	1,461,836	2,758,822	4,973,901	3,516,442	3,134,926	2,757,926	2,649,718
1,000,475	1,097,432	1,199,262	1,426,524	1,027,639	1,402,441	1,020,824	846,657	998,754
4,779,103	3,473,461	3,874,280	4,170,037	4,831,703	5,465,299	5,460,204	4,680,637	4,154,720
8,301,778	7,705,594	7,239,689	7,389,033	6,970,874	7,410,005	7,081,250	6,836,407	6,570,024
6,145,421	8,890,052	9,190,589	9,317,916	7,796,092	10,008,659	9,701,459	8,818,376	7,256,759
2,264,175	2,208,105	3,175,060	3,340,283	2,620,419	3,501,492	3,083,350	3,701,275	2,991,767
391,369	154,270	350,564	246,051	277,465	275,054	262,844	481,357	482,090
364,506	314,598	300,738	326,039	345,566	316,809	372,308	562,206	578,329
89,146,170	91,818,295	107,081,260	103,207,829	88,352,613	99,238,960	86,278,541	86,478,813	81,600,197
17,531,904	25,518,789	37,954,192	36,783,047	38,708,643	36,732,506	32,738,533	31,094,589	37,607,805
507,082	582,759	628,071	591,435	579,170	728,755	700,500	724,847	591,287
859,948	765,259	1,283,080	1,685,451	1,957,516	1,620,252	1,083,153	866,671	1,003,396
968,438	1,385,940	1,338,926	1,197,126	1,545,842	1,117,414	1,305,090	1,065,131	1,117,042
766,118	748,527	681,338	967,088	771,224	860,350	924,912	693,074	702,652
187,367	104,239	187,212	113,797	72,925	121,237	153,972	115,231	92,801
354,026	158,101	519,695	397,383	256,144	309,435	519,859	371,591	285,974
932,936	926,114	838,439	1,372,137	1,120,370	782,862	433,276	237,140	295,086
1,048,917	904,296	1,074,012	1,232,873	1,088,392	1,253,347	1,221,529	694,948	982,172
98,349	114,804	198,304	209,641	263,029	327,071	260,013	226,389	144,877
483,451	470,185	436,835	490,581	474,101	642,376	605,736	350,393	460,464
299,784	523,172	647,331	290,851	227,630	259,186	218,609	150,990	225,754
210,410	297,343	367,655	260,817	249,734	181,542	393,715	138,323	271,696
4,650,485	4,749,816	5,260,670	6,340,414	6,482,144	6,138,521	4,701,443	4,085,209	3,461,135
6,199,211	5,986,008	6,915,419	6,914,319	7,325,319	7,015,333	6,789,243	5,611,857	6,355,195
644,066	371,990	694,593	465,497	836,819	638,878	656,727	626,593	414,203
1,035,145	967.803	1,415,356	1,416,025	1,484,638	1,328,071	1,626,328	1,443,978	1,325,892
1,099,938	828,365	886,628	585,418	1,234,249	945,708	1,158,793	1,878,921	1,646,336
2,393,801	2,137,537	2,541,215	3,414,672	4,265,486	5,050,426	5,938,459	4,760,678	5,322,280
2,199,355	3,738,158	3,456,633	2,730,519	3,436,580	3,429,755	2,595,433	2,496,245	2,277,437
1,292,814	1,048,938	2,165,449	2,686,844	3,152,210	2,188,878	2,212,176	1,551,305	1,744,312
5,232,305	3,388,532	2,652,623	2,189,098	2,684,854	2,250,476	2,082,834	1,884,852	1,665,121
1,591,006	909,011	379,795	945,304	1,168,319	887,305	1,247,137	821,371	981,696
13,604,576	11,056,935	11,834,727	10,703,778	9,936,092	10,141,558	10,140,977	8,614,069	8,040,938
3,949,955	5,140,186	5,515,030	6,234,003	4,891,614	4,528,202	4,405,498	5,515,918	5,415,544
628,805	450,945	531,621	675,711	720,802	663,092	662,441	492,804	565,813
2,905,943	2,997,522	3,813,397	3,152,261	2,407,663	2,601,272	2,604,490	2,298,705	2,319,719
1,285,814	1,458,745	1,890,599	1,585,373	1,725,375	1,738,367	1,477,659	1,232,649	1,063,626
1,389,810	995,032	1,158,941	1,235,473	1,359,842	1,798,042	2,000,860	1,296,114	1,189,284
1,654,676	1,492,903	1,985,090	1,643,659	1,880,282	2,660,362	1,980,836	1,725,299	1,215,394
1,087,588	1,902,897	1,465,500	1,521,361	1,522,129	1,844,486	1,415,071	1,496,615	1,251,560
90,834,632	284,049,237	318,710,760	305,482,829	313,588,711	328,210,074	294,205,658	286,566,222	267,979,429
73,491,150	182,274,391	204,886,897	210,401,583	214,323,097	215,036,149	207,683,949	185,979,476	186,599,306

† Exclusive of French and Spanish Possessions separately stated.

VALUE of TOTAL IMPORTS from, and of TOTAL EXPORTS to,

COUNTRIES—*cont.*		1872.	1873.	1874.	1875.	1876.	1877.
BRITISH POSSESSIONS:		£	£	£	£	£	£
Channel Islands .	Imports	612,851	551,009	650,211	707,309	676,085	724,181
	Exports	861,695	863,430	982,656	791,178	756,115	739,122
Gibraltar .	Imports	104,110	92,905	82,364	111.965	49,918	70,038
	Exports	1,277,021	1,298,817	1,234,030	1,111,203	1,207,541	936,711
Malta . .	Imports	188,017	301,668	285,098	233,569	213,758	286,431
	Exports	973,563	1,139,763	997,774	859,970	1,059,669	987,245
North American Colonies .	Imports	9,130,919	11,727,851	11,858,909	10,212,624	11,023,782	12,035,968
	Exports	11,324,187	9,373,776	10,210,985	9,682,189	8,025,919	8,256,071
West India Islands and Guiana .	Imports	6,445,274	6,475,392	6,188,749	7,326,040	6,894,331	6,934,573
	Exports	3,681,701	3,576,566	3,530,249	3,275,072	3,202,187	3,138,183
British Honduras . .	Imports	175,818	200,869	196,483	203,135	227,896	193,557
	Exports	164,295	161,191	160,475	138,066	125,308	130,198
Australia .	Imports	15,625,866	17,262,706	18,547,710	20,559,154	21,961,929	21,732,338
	Exports	15,482,776	19,225,636	20,668,988	21,224,620	19,470,063	21,503,533
British India .	Imports	33,682,156	29,890,802	31,198,446	30,137,295	30,025,024	31,224,763
	Exports	19,486,806	22,313,988	25,434,912	25,595,119	23,676,898	26,618,896
The Straits Settlements	Imports	3,505,114	3,464,279	2,604,854	3,149,310	2,641,946	2,721,795
	Exports	2,533,909	2,171,819	2,808,014	2,094,177	2,069,463	2,409,828
Ceylon . .	Imports	3,163,153	4,331,006	3,600,492	4,380,821	3,134,183	4,498,579
	Exports	1,064,935	1,107,662	1,239,972	1,131,514	1,134,257	1,105,784
Hong Kong .	Imports	940,922	783,457	747,291	1,154,910	1,356.850	1,895,310
	Exports	3,099,244	3,610,265	3,909,246	3,839,136	3,261,805	3,645,068
Mauritius .	Imports	1,539,565	1,273,910	1,044,233	824,411	936,736	1,891,031
	Exports	591,712	614,467	615,206	379,668	364,067	598,430
Cape of Good Hope and Natal . .	Imports	3,717,465	4,120,915	4,297,285	4,478,960	4,192,416	4,275.398
	Exports	3,993,301	4,645,967	4,702,069	5,350,412	4,683,668	4,502.739
West Africa Settlements	Imports	89,599	86,551	129,884	139,851	132,328	176,111
	Exports	398,567	359,836	420,296	327,928	249,366	322,429
The Gold Coast . .	Imports	*386,746	*386,854	*468,605	*469,955	*548,639	*591,958
	Exports	*446,612	*420,573	*512,000	*524,604	*554,083	*569,756
Other Possessions .	Imports	65,272	59,948	262,225	334,662	316,755	301,967
	Exports	228,894	263,951	483,156	330,155	309,480	288,157
TOTAL OF BRITISH POSSESSIONS	Imports	79,372,853	81,010,122	82,162,839	84,423,971	84,332,576	89,553,998
	Exports	65,609,218	71,147,707	77,910,028	76,655,011	70,149,889	75,752,150
TOTAL OF FOREIGN COUNTRIES AND BRITISH POSSESSIONS .	Imports	354,693,624	371,287,372	370,082,701	373,939,577	375.154,703	394.419,682
	Exports	314,588,834	311,004,765	297,650,464	281,612,323	256,776,602	252.346,020

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* Including Dutch Possessions on the

ie various Foreign Countries and British Possessions—*continued.*

1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.
£	£	£	£	£	£	£	£	£
726,305	737,793	810,435	755,809	849,051	806,423	868,598	809,878	911,570
733,874	813,166	814,799	846,279	787,480	764,394	804,338	708,692	677,025
34,685	35,969	41,275	26,418	32,719	39,211	22,820	15,832	32,805
778,056	739,665	829,673	795,949	830,759	800,779	796,372	715,482	680,944
176,940	184,891	201,010	169,797	155,593	151,578	176,052	78,841	94,717
1,371,310	954,054	1,010,090	1,137,189	1,194,160	1,159,264	1,146,282	1,178,491	1,058,963
9,530,832	10,445,694	13,388,988	11,300,818	10,398,850	12,283,727	11,039,729	10,347,190	10,415,388
7,033,496	6,118,862	8,516,019	9,307,341	10.682,942	10,109,596	9,686,737	8,374,632	9,040,844
6,149,993	7,066,269	6,571,474	5,695,626	6,529,658	4,887,588	4,923,351	3,960,211	2,944,360
2,891,063	2,947,515	3,249,693	2,900,400	3,466,954	3,752,545	3,394,736	2,638,007	2,538,223
182,495	228,004	189,827	202,996	239,486	249,006	282,590	230,946	220,651
122,006	98,622	112,887	114,418	125,748	141,836	124,427	107,805	91,034
20,855,021	21,964,440	25,663,334	26,975,381	25,174,588	25,936,201	28,310,697	23,325,287	20,954,440
21,525,549	17,959,705	18,748,092	23,982,404	28,450,751	26,839,490	26,804,740	28,104,258	25,005,428
27,470,473	24,698,213	30,117,980	32,629,435	39,921,127	38,882,829	34,448,132	31,882,665	32,130,507
24,659,167	22,714,682	32,028,055	31,052,963	30,581,860	33,382,786	32,062,109	30,878,665	32,517,161
2,536,958	2,565,361	3,697,624	3,784,157	4,580,499	4,643,016	4,612,414	4,442,166	4,372,622
1,882,785	2,182,637	2,459,659	2,743,518	2,495,121	2,793,106	2,816,298	2,524,735	2,259,581
2,922,219	3,568,965	3,386,369	2,136,350	2,408,038	2,172,736	2,366,771	2,389,492	2,083,636
850,553	827,119	1,036,900	849,499	770,524	759,079	782,053	565,955	602,414
1,174,469	1,327,085	1,253,541	1,015,716	1,429,749	1,171,986	1,052,302	968,414	1,556,062
3,041,329	3,128,227	3,967,792	3,800,189	3.143,674	3,047,470	3,587,487	4,062,182	2,559,766
887,009	641,836	284,485	449,487	445,672	414,953	356,554	307,364	309,571
431,552	366,541	385,726	481,773	546,778	580,558	428,092	293,781	292,297
4,381,027	4,610,379	5,638,522	5,413,299	6,274,895	5,895,909	5,948,600	4,456,450	4,670,765
5.458,966	6,369,876	7,206,000	7,691,965	8,077,615	5,000,251	4,532,949	4,182,196	3,627,154
128,540	118,124	157,964	160,730	263,885	241,509	254,932	141,271	156,454
414,070	371,025	388,654	317,711	361,085	415,801	405,845	249,146	422,760
*492,682	*462,026	*621,284	*349,464	*368,958	*488,106	*844,324	*738,538	*670,394
*557,707	*475,330	*502,223	*394,524	*514,683	*510,213	*594,852	*504,165	*435,321
286,462	287,589	494,693	474,177	358,129	416,727	305,045	307,188	360,101
241,225	441,947	271,307	265,070	307,483	343,753	336,317	336,026	258,796
77,936,110	78,942,638	92,518,805	91,539,660	99,430,897	98,681,505	95,812,911	84,401,733	81,884,043
1,992,708	66,508,973	81,527,569	86,681,192	92,337,617	90,400.921	88,303,634	85,424,218	82,067,711
8,770,742	362,991,875	411,229,565	397,022,489	413,019,608	426,891.579	390,018,569	370,967,955	349,863,472
5,483,858	248,783,364	286,414,466	297,082,775	306,660,714	305,437,070	295,967,583	271,403,694	268,667,017

old Coast ceded to Great Britain on 6th April, 1872.

The following Tables, giving the population of the United Kingdom engaged in occupations connected with the sea, are extracted from the Report of the Census of 1881:—

ENGLAND AND WALES.

Ship, Boat, Barge Builders	21,741
Shipwrights, Ship-Carpenters (ashore)	23,930
Ship Riggers, Chandlers, Fitters	2,861
Anchor, Chain manufacturers	5,029
Mast, Yard, Oar, Block makers	1,419
Sail makers	4,129
Total engaged in making or equipping vessels	59,109
Seamen (Merchant Service) enumerated	95,093
Seamen (English and Welsh) abroad	63,330
Bargemen, Lightermen, Watermen	30,223
Boatmen on Seas	1,570
Pilots	2,991
Ship Stewards, Cooks	6,767
Total seagoing persons	199,974
Navigation Service (on shore)	4,697
Harbour, Dock, Lighthouse Service	42,643
Total of Shore Service	47,340
Total engaged in Water Traffic	306,423

Neglecting, as insignificant in number, the few professional fishermen in inland waters, the fishermen are, of course, limited by the nature of their industry to the maritime districts. Their distribution, following the coast line, was as follows:—

Northumberland	1,402	Dorsetshire	370
Durham	327	Devonshire	1,826
North Riding	1,232	Cornwall	4,400
East Riding	2,003	Somersetshire	59
Lincolnshire	4,357	Gloucestershire	105
Norfolk	2,898	South Wales	637
Suffolk	2,763	North Wales	284
Essex	980	Cheshire	334
Kent	1,793	Lancashire	1,342
Sussex	1,473	Cumberland	149
Hampshire	527		

The Census for Scotland gave 22,354 males on canals, rivers, and seas at the date of enumeration; also 16,647 employed in shipbuilding, and 1,823 riggers.

For Ireland the Census gave 17,256 males on canals, rivers, and seas; 2,532 employed in shipbuilding, and 253 riggers.

NUMBER of PERSONS, distinguishing BRITISH and FOREIGN, employed in VESSELS (registered under the Merchant Shipping Acts) belonging to the UNITED KINGDOM, ISLE OF MAN,* and CHANNEL ISLANDS (exclusive of Vessels employed on Rivers and in Inland Navigation), which were returned as employed in the Home and Foreign Trades, showing the proportion of Foreigners to every 100 British Subjects in each Year from 1851 to 1886.

(Masters are not included in this Return.)

Year.	Number of British Persons Employed.	Number of Foreign Persons Employed.	Total Number of Persons Employed.	Proportion of Foreigners to every 100 British Subjects Employed.
1851	136,144	5,793	141,937	4·2
1852	153,863	5,700	159,563	3·7
1853	165,205	7,321	172,526	4·4
1854	149,215	13,200	162,415	8·8
1855	155,610	12,927	168,537	8·3
1856	160,597	13,321	173,918	8·3
1857	162,012	14,375	176,387	8·9
1858	165,498	12,334	177,832	7·4
1859	160,210	12,296	172,506	7·6
1860	157,312	14,280	171,592	9·0
1861	Not separated.		171,957	—
1862	157,767	16,096	173,863	10·2
1863	165,794	18,933	184,727	11·4
1864	173,833	21,923	195,756	12·6
1865	177,363	20,280	197,643	11·4
1866	Not separated.		196,371	—
1867	174,523	21,817	196,340	12·5
1868	177,239	20,263	197,502	11·4
1869	175,332	20,158	195,490	11·4
1870	177,951	18,011	195,962	10·1
1871	181,973	17,765	199,738	9·76
1872	183,129	20,591	203,720	11·24
1873	182,399	19,840	202,239	10·87
1874	182,687	20,919	203,606	11·45
1875	178,994	20,673	199,667	11·55
1876	177,727	20,911	198,638	11·76
1877	173,926	22,636	196,562	13·01
1878	172,242	23,343	195,585	13·55
1879	169,145	24,403	193,548	14·43
1880	169,692	23,280	192,972	13·72
1881	168,098	24,805	192,903	14·76
1882	169,920	26,017	195,937	15·31
1883	172,414	28,313	200,727	16·42
1884	171,871	27,783	199,654	16·17
1885	171,585	27,196	198,781	15·85
1886	162,614	25,183	†187,797	15·49

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* Only such Foreign-going vessels belonging to the Isle of Man for which crews were engaged at ports in the United Kingdom are included.

† Not including 16,673 Lascars and Asiatics under Asiatic articles of agreement, whose numbers have been ascertained and recorded for the first time this year. The total, including such Lascars and Asiatics, is 204,470. For the purpose of the comparison in the present Table, a figure on precisely the same basis as in former years is used.

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